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A Revision of the American Moths of the Family Carposinidae (Lepidoptera: Carposinoidea)

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FRANK A. TAYLOR
Director, United States National Museum

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Contents

	Page
Introduction	1
Review of literature and classification	2
Biology	3
Morphological characters	6
Checklist	10
Carposinidae	11
References	67
Figures	71
Index	100

A Revision of the American Moths of the Family Carposinidae (Lepidoptera: Carposinoidea)

Introduction

This report presents the first review of the Carposinidae known to inhabit the Nearctic and Neotropical regions. References treating the New World species previous to this account are exceedingly brief, largely devoid of illustrations or keys, and consist almost entirely of descriptions of new taxa. A world catalog for the family, however, was compiled in 1922 by Edward Meyrick. This reference, together with Clarke's (1963) illustrations of the carposinid types described by Meyrick, and Diakonoff's (1954) key to all the genera, probably represent the most significant contributions on the Carposinidae to date. The most noteworthy attention directed at this family in the New World was a brief account presented by Forbes (1923) wherein the family was defined and four species (including one synonym) were described.

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I am indebted to Mr. Andre Pizzini, staff artist for the Department of Entomology, Smithsonian Institution, for all drawings. Nearly all

photographic work was performed by Mr. Jack Scott, staff photographer of the Smithsonian Institution. The photographs of the holotypes of *Carposina phycitana* and *Carposina cardinata* are the courtesy of the British Museum (Natural History); the photograph in figure 2 was acquired through the assistance of Mr. George Okumura. The outline maps of the United States, North and South America are from the Goode Base Map Series and are used with the permission of the Department of Geography, University of Chicago (copyright by the University of Chicago).

The following list of abbreviations represent the deposition of specimens as cited in this publication:

ABK	Collection of Alexander B. Klots, New York, New York.
AEB	Collection of Auburn E. Brower, Augusta, Maine.
AFB	Collection of Annette F. Braun, Cincinnati, Ohio.
AMNH	American Museum of Natural History, New York, New York.
BM	British Museum (Natural History), London, England.
CAS	California Academy of Sciences, San Francisco, California.
CDA	California Department of Agriculture, Sacramento, California.
CMNH	Chicago Museum of Natural History, Chicago, Illinois.
CNC	Canadian National Collection, Ottawa, Canada.
CPK	Collection of Charles P. Kimball, West Barnstable, Massachusetts.
CU	Cornell University, Ithaca, New York.
JGF	Collection of John G. Franclemont, Ithaca, New York.
MOG	Collection of Murray O. Glenn, Henry, Illinois.
NSM	Nova Scotia Museum, Halifax, Canada.
UCB	University of California, Berkely, California.
USNM	United States National Museum, Washington, D.C.
VNM	Vienna Naturhistorisches Museum, Vienna, Austria.

Review of Literature and Classification

The family Carposinidae presents a rather interesting problem, not too frequently encountered in the Lepidoptera, of a relatively homogenous, easily defined group of insects which has become so well isolated from related groups through the extinction of annectant forms that any attempt to assess family relationships for the group now proves quite difficult. The problem in determining family affinities for the Carposinidae was early noted by Meyrick (1922) and later re-emphasized by Diakonoff (1954).

Several major features serve to distinguish the Carposinidae from related families and superfamilies. Among the more characteristic are: the raised scale tufts on the forewings; the loss of one and often two medial veins in the hindwings; the sexually dimorphic character of the antennal cilia; the tendency toward strong sexual dimorphism in the labial palpi; and the general morphology of the male and female genitalia. In the case of the latter, the typically spinose aedeagus of the male and the somewhat extended ovipositor of the female should

be mentioned. The larva demonstrates its uniqueness by possessing only two prespiracular setae on the pronotum, thus differing from the typical number of three found in nearly all microlepidopterous larvae.

The genus *Carposina*, with two included species, was first proposed by Herrich-Schäffer in 1855, who included it in his polyglot concept of the family Tineidae. Subsequent authors tended mainly to treat the genus either as an aberrant member of the Gelechiidae or to include it somewhere among the Tortricoidea. After studying some of the Australian species, Meyrick (1882) separated *Carposina* from the Gelechiidae largely on the basis of venational and palpal characters and considered it to be a member of the Conchylidae (Tortricina). The first authority to advocate the separation of these moths as a distinct group was Walsingham. In 1897, this author proposed the Carposinae as a new subfamily of Tortricidae for a previously undescribed African genus and species, *Autogriphus luteus*. The other two coordinate subfamilies he included in his paper were the Tortricinae and Olethreutinae. In Fauna Hawaiiensis, Walsingham (1907) emphasized the separation further by raising the group to family rank. Busck (1907) apparently unaware of Walsingham's earlier treatment, stated that the genus *Carposina* belonged to a very abnormal group of the subfamily Phaloniinae along with one Japanese and three Australian genera. Busck further suggested that the group might warrant a separate subfamily status. Since that time the treatment of these moths as comprising a distinct family within the Tortricoidea has been rather consistent. In one of the most recent discussions on the supergeneric classification of the Tortricoidea, Diakonoff (1961) again pointed out several unique or unusual features of the Carposinidae and proposed a new superfamily, Carposinoidea, for this group of moths. This treatment has been followed in the present paper.

Biology

Distribution.—In the most recent catalog of the Carposinidae, Meyrick (1922) listed 8 genera and 128 species for the world. In 1954, Diakonoff recognized 24 genera for the world and proposed 31 new species from New Guinea alone. The present size of the family probably approximates 200 described species.

The zoogeographical distribution of the group strongly suggests an Indo-Australian origin for the family. Approximately three-quarters of the world's genera and species are known from this area, and most of these occur no where else. Meyrick (1922) listed 6 genera and 31 species from Australia, and Diakonoff (1954) recorded 10 genera and 44 species as occuring in the Papuan region. Subsidiary centers of speciation have developed in Oceania around the southern periphery

of the primary center of distribution. Principal among these are the Hawaiian Islands with 37 species but only a single genus. This situation is probably the result of a relatively rapid proliferation of one or a few early introductions which underwent an evolutionary radiation similar to that which occurred in the immensely successful Hawaiian cosmopterygid genus *Hyposmocoma*. The Carposinidae evidently experienced a comparable development in New Zealand. Although only one genus is known to occur there, it is well represented by 15 species as reported by Philpott (1928). Currently these species are listed under *Carposina;* however, as suggested by certain peculiarities in the male genitalia, all very likely will require a new generic placement eventually.

The remaining regions of the world exhibit a rather depauperate fauna with regard to this family. Meyrick (1922) reported only 8 species from the Palearctic region (4 are known from Japan alone) and 9 from the Ethiopian region. In this paper I have recognized a total of 4 genera and 18 species for the New World, as well as 4 unnamed species. Undoubtedly several Neotropical species remain to be discovered, although recent collecting has not indicated this fauna to be of any great size or complexity. Members of two monotypic genera, *Tesuquea* and *Atoposea*, are restricted to the Western Hemisphere, whereas the genera *Carposina* and *Bondia* are also represented in the Old World. The genus *Carposina* is perhaps the most widespread of all the known genera, although, as pointed out above, this name probably has been misapplied in some areas to unrelated species groups. The most widely distributed species is probably *C. niponensis* which occurs commonly over much of China and Japan. As discussed in the present paper (see p. 18), this insect is believed to be represented in North America by the subspecies *ottawana*.

Life history.—Except for accounts treating a few economic species, very little is known concerning the life history of these insects. The larvae of several species (of the genus *Carposina* in particular) are known to bore into fruits, and one is a major pest of apple and peach in Japan. Meyrick (1922) points out that in addition to feeding in fruits, some larvae are known to bore into plant shoots, stem galls, and bark, as well as to mine leaves. The plant families Campanulaceae, Epacridaceae, Ericaceae, Myrtaceae, and Rosaceae are listed by him as hosts.

Due to its economic importance as a major pest of pome fruits in the Far East, more attention has been directed toward understanding the biology of *Carposina niponensis* than to any other member of the family. Early reports (e.g., Riley et al., 1889) outlined the life history of this moth several years before the species had actually been identi-

fied and named. Later studies, primarily by Japanese workers such as Hukusima (1953, 1957) and Miyashita et al. (1955), have increased our knowledge considerably. Two generations a year apparently is the average number for this species in Japan, although from one to three generations are possible depending upon the latitude and local climatic conditions. Although the adult moth has been reported to be primarily crepuscular, Hukusima (1953) observed that adult activity was influenced primarily by air temperature, with humidity, light intensity, and wind velocity playing a decidedly lesser role. He recorded maximum activity at about 20°C and decreasing rapidly above 25°C and below 18°C. Even though more than one activity period may appear during the course of a day, however, the maximum period does appear to commence after sunset. The eggs are deposited externally, singly, and usually in the hairy cavities or basins of the fruit. Occasionally, eggs are deposited on the petiole and upper surface of the leaves. Experiments by Hukusima (1957) indicate that the female relies largely on a tactile sense in selecting an oviposition site, with optic and olfactory responses exerting less influence. It was also observed that the moths displayed a decided preference to deposit eggs on the more hairy surfaces of the fruit as opposed to smoother surfaces. The eggs are yellowish, spherical in form, and approximately 0.5 mm. in diameter. Upon hatching from the egg, the newly emerged larva at first seeks out a suitable place to enter the fruit and then bores in, feeding on the fleshy parts of the fruit as well as on the seeds. Occasionally a developing larva may leave one fruit and enter another. Immediately prior to pupation, the full grown larva enters the ground beneath the host tree to a depth of one or two inches and constructs a tough, oval cocoon of light gray silk. The pupation period for the summer brood(s) normally requires about two weeks; however, in the case of the last brood of the season, the larva overwinters inside the cocoon and pupates the following spring, with the adults of the first brood emerging shortly thereafter.

Only one chromosome study has been attempted in this family and that was by Saitoh and Yamada (1966) on *Carposina niponensis*. These authors report a haploid count of 31 chromosomes of approximately equal size. In the few Tortricidae studies thus far (Makino, 1951) a haploid number of 30 has been observed with one large chromosome present in the set. Too little information is presently available to comment on the relative significance of the observed karyotypic differences between these two families.

Literature pertaining to the life history of the New World species is scant indeed. No biological studies have been conducted, although a few brief notes relating host information have appeared from time to time on certain North American species. Forbes (1923) briefly

mentioned the presence of the larva of *Carposina fernaldana* in nearly ripe currants. A short note on the prune limb borer, *Bondia comonana*, was presented by Kiefer (1943) in which the larva was described as a borer in the soft, gummy enlargements on the trunks of peach trees. This species is also known to bore in healthy branches and sometimes enters the fruit of its host. Reportedly, it passes the winter as a pupa protected inside a cocoon.

The biology of a Japanese species, *Commatarcha palaeosoma* Meyrick apparently is very similar to the North American *Bondia comonana*. According to Yano (1959), the larvae of *C. palaeosoma* bore under the bark of certain species of trees belonging to the family Fagaceae and produce gall-like protuberances; however, no mention is made by Yano of any attempts to actually determine the cause of the swellings, and it is likely that the moth was merely assumed to be the principle agent involved. In general appearance these protuberances, as illustrated by Yano, closely resemble the black knot disease so common on several species of North American *Prunus*. As discussed on p. 45 this particular disease is caused by an ascomycetous fungus, *Plowrightia morbosa* (Schw.) Sacc. The larva of *B. comonana* has been reared from black knot galls on numerous occasions and may actually aid in disseminating the spores of this disease; however, the growth and development of the fungus seem to be the principal cause of the disease symptoms. Very likely the tumorous swellings discussed by Yano are actually caused by a similar pathogen, with the larvae of the moth becoming involved at a later stage of the cycle, or at most, assisting in the transmission of the disease.

Morphological Characters

A few morphological features due to their relative complexity or importance to the systematics of this family deserve special emphasis.

Head.—All species of Carposinidae examined in the course of this study demonstrated a sexual difference in the structure of the antennae. The sensory cilia arising from the venter of the shaft are greatly elongated in the male, frequently several times longer than the diameter of the antenna. In all females studied, the cilia are considerably shorter, usually no more than half the diameter of the shaft in length.

The mandibles are very reduced in size, but are present in all New World genera. The maxillary palpi are also greatly reduced but present. Typically they consist of a single, globose segment (fig. 41), but in some specimens of *Carposina*, a minute, budlike apical segment or constriction can be observed. Philpott (1926) reported a typical, one segmented palpus in two genera studied by him.

The labial palpi, similar to the antennae, often show evidence of sexual dimorphism. This difference is to be noted in the scaling along

the segments as well as in the overall length of each segment. Most of the differences with regard to the length and curvature of the labial palpi is to be attributed to the morphology of the second segment. In the females of most species this segment is longer and straighter than in the males. In some genera it can also be noted that the apical segment of the male palpus is somewhat more slender and longer than that of the female.

THORAX.—The application of wing venation in the classification of this family presents some problem with regard to character weighting. Very likely no satisfactory evaluation will be achieved until most of the species have been properly described and studied as a group. As the situation appears at present, considerable interspecific variation occurs in this family (in proportion to the number of known species), but relatively little intraspecific variation. That is to say, for those species studied thus far, venational characters appear quite stable for a given species even though distinct differences often exist between species or species-groups. In an attempt to obtain some idea as to the range and magnitude of this variation, three sets of diagnostic venational characters were investigated for those species represented by adequate series. A summary of those observations is given in table 1. The particular veins studied were so selected because they exhibited the greatest amount of variation. All other major veins were noted to be relatively stable in their origins.

As can be noted from table 1, veins 4 and 3 (M_3 and Cu_1) of the hindwings exhibit the greatest amount of intraspecific variation. In spite of such variation, characteristics involving this particular set of veins still provide one of the best single means for superficially separating the two genera *Carposina* and *Bondia*. It is obvious from a study of the American species that for generic evaluation venation must be considered in conjunction with as many additional features as possible and especially with characters of the male and female genitalia. Unfortunately this has not always been possible due to the lack of adequate material.

MALE GENITALIA.—I have interpreted the uncus as being present in the American species even though its presence is very slight in most forms. In *Tesuquea* and certain Old World genera (e.g., the New Zealand species of "*Carposina*") the uncus is very prominent; in *Bondia* and *Carposina* it is represented by a minute lobe which is largely fused to the tegumen. Some authors may chose to consider this as merely a lobe of the tegumen.

Within the Carposinidae, and particularly in the genera *Carposina* and *Meridarchis*, the gnathos may be observed in various stages of development. In most forms the two arms of the gnathos are widely separated and appear as short, lobelike enlargements from the latero-

TABLE 1.—Venational Characters

Species	N	Wing	Veins	Character frequency		
				Separate	Connate	Stalked
CARPOSINA						
bullata	18	fore	8–9	18	0	0
		fore	3–4	0	0	18
		hind	3–4	0	12	6
cretata	6	fore	8–9	0	0	6
		fore	3–4	0	0	6
		hind	3–4	0	6	0
dominicae	25	fore	8–9	0	0	25
		fore	3–4	0	1	24
		hind	3–4	9	16	0
fernaldana	51	fore	8–9	51	0	0
		fore	3–4	50	1	0
		hind	3–4	0	40	11
niponensis ottawana	32	fore	8–9	32	0	0
		fore	3–4	32	0	0
		hind	3–4	0	20	12
BONDIA						
comonana	55	fore	8–9	55	0	0
		fore	3–4	55	0	0
		hind	3–4	55	0	0
crescentella	62	fore	8–9	62	0	0
		fore	3–4	60	1	0
		hind	3–4	60	2	0
fidelis	101	fore	8–9	100	0	1
		fore	3–4	99	2	0
		hind	3–4	0	19	82
fuscata	19	fore	8–9	19	0	0
		fore	3–4	19	0	0
		hind	3–4	0	0	19
shastana	48	fore	8–9	48	0	0
		fore	3–4	48	0	0
		hind	3–4	44	4	0

ventral margin of the tegumen. Occasionally the lobes become greatly extended (as in *C. niponensis ottawana*) and equipped with strong tufts of setae. Both halves of the gnathos are fused together in *Tesuquea hawleyana*, thus resembling the common condition found in several families of Lepidoptera which possess this structure. The complete absence of a gnathos in *Bondia* provides one of the better characters for separating this genus from *Carposina*.

A subscaphium is presently known to occur in only one American species, *Atoposea maxima*. Furthermore, such a structure has not been reported in any Old World species.

A curious structure present in the adeagus of several New Zealand Carposinidae and referred to as the vitta by Philpott (1928) apparently does not occur in any American species. The vitta is an elongate, ribbonlike filament extending from one of the apical lobes of the aedeagus. Usually its length either equals or exceeds that of the main body of the aedeagus. The function of the vitta is not known, but likely it assists in sperm transfer.

Female genitalia.—Frequently the ductus bursae, or certain portions of it, are provided with heavily thickened walls. This feature is especially prevalent in *Carposina* and in several Old World genera such as *Anomoeosis* and *Meridarchis*. In the American species, usually only the caudal third or fourth of the ductus is strongly dilated and thickened. For this reason I have used the term antrum and have referred to the remaining, more constricted portion of the tube as the ductus bursae even though the antrum is technically a part of the ductus. Under high magnification the walls of the antrum usually may be observed to resemble a fine reticulum composed of thousands of relatively large cellular partitions. Over most of the antrum these cells are formed as small, columnar papillae. Frequently they are crowded so tightly together that their walls assume a hexagonal outline typical of cells in such dense situtations. Anterior to the antrum the cells gradually become more flattened (i.e., less papillose), thinner walled and more rounded. In no case were they observed to extend very far beyond the anterior end of the ductus bursae.

Little variation has been observed in the structure or condition of the signum. This feature is either completely absent or, if present, then represented by a strongly furcate and approximately symmetrical pair. Each ramus is compressed, slightly curved, and serrated along its concave edge. The only significant variation noted in the American species was in *Carposina bullata* where one ramus of each signum may occasionally be subdivided.

Frequently present in the corpus bursae of most females are one and less commonly two or three rather large spermatophores. Although the overall structure of the spermatophore does not appear

in most cases to be of specific value, it may have some taxonomic significance at a generic level; however, the virtual absence of published comparative data in conjunction with a general paucity of study material make it difficult to assess the relative value of this character.

In general, the carposinid spermatophore consists largely of a thick-walled, rodlike shaft which often becomes folded or coiled within the bursa. At some point along the shaft, often at the anterior end, the walls become abruptly reduced in thickness and dilate to form a membranous sac from which the sperm escape as soon as the sac is ruptured.

With regard to the American species, the spermatophore is rather similar among the members of *Carposina* in possessing an abruptly swollen anterior end, which in turn often terminates in a small, slender appendage. The genus *Bondia* exhibits greater interspecific variation, and as a group differs from *Carposina* in the reduction of the inflated portion. Some species (e.g., *B. comonana* and *B. crescentella*) possess a slight membranous enlargement at the anterior end, whereas in others (e.g., *B. fidelis* and *B. fuscata*) this occurs approximately midway along the main shaft.

Checklist

1. Carposina Herrich-Schäffer
   Carposina, subgenus sensu strictu
      1. niponensis ottawana Kearfott
         nicholsana Forbes
      2. fernaldana Busck
      3. simulator Davis
      4. biloba Davis
      5. engalactis Meyrick
      6. phycitana Walsingham
   Trepsitypa Meyrick, subgenus
      7. cardinata (Meyrick)
   Dipremna Davis, subgenus
      8. cretata Davis
   Epipremna Davis, subgenus
      9. dominicae Davis
   Hypopremna Davis, subgenus
      10. bullata Meyrick
2. Atoposea Davis
      11. maxima (Meyrick)
3. Bondia Newman
      12. comonana (Kearfott)
      13. crescentella (Walsingham)
      14. shastana Davis
      15. spicata Davis
      16. fidelis Meyrick
      17. fuscata Davis

4. Tesuquea Klots
   18. hawleyana Klots
   Unnamed Species
   19. Carposina species no. 1
   20. Carposina species no. 2
   21. Bondia species no. 1
   22. Bondia species no. 2

Carposinidae

ADULT.—Medium to small, slender bodied moths; coloration typically of a cryptic pattern, ranging in shades of brown to black and occasionally green; wing expanse usually between 10 to 38 mm.

Head: Front and vertex smooth; occiput rough, with a pair of lateral tufts which converge medially; chaetosema absent. Antennae simple in both sexes, of moderate length, never exceeding three-fourths of forewing; heavily scaled to apex dorsally, pubescent ventrally in female, densely ciliate ventrally in male, length of cilia 2–5 × diameter of shaft; pecten absent. Eyes naked, well developed, rounded. Ocelli usually absent, present in a few Old World genera. Mandibles present, minute. Tongue present, relatively weak, usually about 1.5 to 2 × the length of labial palpi; maxillary palpi minute, typically one-segmented; segment ovoid, nearly as broad as long. Labial palpi three-segmented, often sexually dimorphic, being more elongate and porrect in female with dorsum of second segment roughened; male with relatively short, subascending palpi; dorsum of second segment usually smooth, venter rough, often strongly tufted; third segment in both sexes much shorter in length, covered by closely appressed scales, and well set off from second segment.

Thorax: Legs and thorax completely covered by moderately broad, appressed scales. Epiphysis (fig. 72) present on fore tibia; middle tibia with two apical spurs; hind tibia with two medial and two apical spurs, dorsum clothed with elongate hairs (fig. 73). Wings relatively broad, tending to be more slender in *Tesuquea* and in most species of *Bondia;* dorsal surface of forewing with usually 4–6 raised scale tufts or ridges; all major veins usually present in primaries (vein 9 absent in *Metrogenes*); vein 7 (R_5) terminating below apex on outer margin; no accessory or intercalary cells present; base of medial vein absent within discal cell; 1A lost, 2A forked for a short distance at base, 3A perhaps present as lower branch of fork. Hindwings either 6- or 7-veined; vein 5 (M_2) absent; 6 (M_1) either lost or faintly present; apex produced, subacute; termen relatively straight, occasionally slightly excavate; hind margin with fringe usually long, sometimes nearly equaling width of hindwing.

Abdomen: Relatively short in length, posterior end frequently not exceeding fringe of hindwing; abdominal sclerites unmodified.

313-145 O—68——2

Male genitalia.—Uncus present, simple, greatly elongate in some genera, although reduced and indistinct in most American species. Tegumen moderately to well developed. Gnathos usually present, typically widely separated into a pair of digitate arms frequently bearing a dense patch of stout setae near apex. Socii absent. Subscaphium usually absent, present in *Atoposea*. Transtilla usually present and weak, often with a pair of small, digitate processes arising near juncture of valvae, transtilla well developed in some genera, with median portion thickened and strongly arched. Vinculum often weak, forming a narrow, V-shaped ring articulating with bases of valvae; sometimes more developed and massive (as in *Bondia*), with apex extended into a short but prominent saccus. Valvae of various form, often elongate and relatively broad to apex, sometimes more reduced and stocky; a clavate or clawlike ampulla present in several genera, completely absent in others. Juxta usually present, either peltate or furcate. Aedeagus usually slender and rodlike, sometimes throughout its length, but often with apical half expanded and armed with dense rows or clusters of stout cornuti; ejaculatory duct usually connected to aedeagus near middle at base of expanded apical portion. Spermatophore elongate, apical end either inflated or similar to rest of shaft in diameter; escape aperature for sperm either at apical end or midway along shaft; length of spermatophore often exceeding that of entire bursa copulatrix.

Female genitalia—Ovipositor moderately long, telescoping; anal papillae unmodified, soft and hairy; posterior apophyses elongate, usually about 1.5–2.5 × the length of anterior pair; anterior apophyses arising from area lateral to sterigma. Lamella antevaginalis usually prominent, broad; posterior margin variously sculptured. Lamella postvaginalis usually indistinct, unmodified. Caudal fourth or third of ductus bursae strongly dilated to form a large, thick walled cavity (antrum); walls frequently heavily papillose or reticulate; remainder of ductus either completely membranous or with broad, thickened bands extending full length to corpus. Corpus bursae either abruptly swollen and distinctly set off from ductus or tubular and indistinct; signa either absent or present as a pair of strongly furcate structures; arms of signa usually slightly curved and serrated along inner edge, smooth on outer edge.

Key to the American Genera of Carposinidae

1a. Hindwings with veins 3 and 4 connate or nearly so; if stalked then fused portion never exceeding one-sixth the total length of 3. Male with gnathos divided into a pair of elongate, usually setose arms (figs. 59–63). Female typically with a pair of furcate signa (absent in *Carposina dominicae* and *Carposina* species no. 1.

2a. Hindwings with vein 2 arising from lower margin of cell at middle (fig. 34). Male with subscaphium present (fig. 63); gnathos without setae . . . . . **Atoposea,** new genus

2b. Hindwings with vein 2 arising from outer third or fourth of cell (figs. 27–33). Male without a subscaphium; gnathos densely setose. **Carposina**

1b. Hindwings with veins 3 and 4 separate, or if stalked then length of fused portion greater than one-fourth the total length of 3 (figs. 37–38). Gnathos usually absent in male, or if present then not divided (fig. 71). Female without signa.

2a. Forewings with vein 10 arising from discal cell much closer to 9 than to 11 (fig. 38); 2 slightly curved and arising distant from 3 at outer third of cell . . . . . **Tesuquea**

2b. Forewings with vein 10 arising approximately equidistant between 11 and 9 (fig. 35); 2 strongly curved, arising close to 3 near lower angle of cell . . . . . **Bondia**

Carposina Herrich-Schäffer

Carposina Herrich-Schäffer, 1855, Systematische Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 38, pl. 12, figs. 1–2.—Meyrick, 1882, Ent. Monthly Mag., vol. 19, p. 69.—Fernald, 1893, Canadian Ent., vol. 25, no. 4, p. 96.—Dyar, 1902 [1903], U.S. Nat. Mus. Bull. 52, p. 489.—Busck, 1907, Journ. New York Ent. Soc., vol. 15, no. 1, pp. 19, 34.—Fernald, 1908, The genera of the Tortricidae and their types, pp. 34, 59.—Meyrick, 1910, Proc. Linn. Soc. New South Wales, vol. 35, pt. 1, p. 146.—Walsingham, 1914, Biol. Centrali-Americana, Heterocera, vol. 4, p. 299.—Barnes and McDunnough, 1917.—Check List of the Lepidoptera of Boreal America, p. 180.—Meyrick, 1922, Gen. Insect., fasc. 179, pp. 2, 4.—Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 515; 1928, *in* Leonard, Cornell Univ. Agric. Exp. Sta. Mem. 101, p. 570.—Fletcher, 1929, Mem. Dept. Agric. India, Ent. series, vol. 11, p. 40.—Philpott, 1928, Trans. Proc. New Zealand Inst., vol. 59, pt. 3, p. 476.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61.—Diakonoff, 1954, Verhandel. Konink. Nederl. Akad. Wetensch., Afd. Natuur., vol. 49, no. 4, p. 119.—Swatschek, 1958, Abhand. Larvalsyst. Ins., no. 3, p. 248.—Razowski, 1959, Bull. ent. Pologne, Wroclaw, vol. 29, no. 9, p. 163.

Type-species.—*Carposina berberidella* Herrich-Schäffer, 1855, designated by Fernald, 1908.

Adult.—Moderately small slender bodied moths; wing expanse approximately 11–20 mm.

Head (figs. 39–43): Antennae with ventral cilia sexually dimorphic; in female cilia minute, less than one-half the diameter of shaft; much more elongate and filamentous in male, length of cilia usually 3–5 ×diameter of shaft; antennae heavily scaled above, largely naked below. Labial palpi sexually dimorphic; relatively short and subascending in male with second segment smooth above, roughened into a tuft beneath; length of segment equal to vertical diameter of eye; palpi porrect and more elongate in female; second segment twice the diameter of eye in length; slightly roughened toward apex below, with

pronounced tuft of raised scales above; apical segment short, usually conical in male and with oblique apex, more cyclindrical and obtuse in female.

Thorax: Wings (figs. 27–33) relatively broad; termen somewhat truncate, not strongly oblique. Forewings either with all veins arising separate from discal cell or with one or two pairs stalked; origin of 11 and 10 variable according to subgenus; 2 strongly curved, arising from lower angle of cell very near 3. Hindwings with discal cell extending half way to termen or less, veins 5 and 6 absent; the latter sometimes represented by a faint vestige; 3 and 4 normally connate, occasionally separate in *C. dominicae*, sometimes stalked for short distance of less than one-sixth the length of 3. Cubital pecten present. Marginal fringe of both wings relatively short.

Male genitalia.—Uncus greatly reduced. Tegumen relatively broad, with a dense row of elongate setae usually arising from area at base of vestigial uncus. Gnathos prominent, widely separated, and setose; setae usually projecting in a cluster beyond apex of gnathos. Transtilla weakly developed, narrow, with a pair of slender digitate processes arising from area adjoining valvae. Valvae typically divided into two distinct halves; basal half (sacculus) expanded and often bearing a prominent ampulla; distal half (cucullus) accuminate, heavily setose on inner face. Juxta usually shield-shaped, sometimes strongly furcate. Vinculum weak, reduced to a narrow ring ventrally; saccus usually distinct but reduced in size. Aedeagus with apical half expanded and basal half slender, rodlike; cornuti numerous, usually arranged in two or more dense patches; juncture of ejaculatory duct near middle, at base of expanded portion. Spermatophore with apical end membranous and greatly dilated; usually with a slender, twisted terminal strand of tissue extending from apex of inflated portion.

Female genitalia.—Ovipositor varying in length, either elongate or relatively short; posterior apophyses varying from 1.25–2.5 × length of anterior pair. Sinus vaginalis broad, expanded. Caudal portion of ductus bursae (antrum) greatly expanded, walls thickened, usually reticulate or papillose; remainder of ductus bursae usually constricted, walls partly membranous, partly thickened. Corpus bursae usually abruptly expanded, ovoid, membranous, typically with a pair of prominent, strongly furcate signa; arms of signa slightly curved as viewed laterally, inner edge of arms serrate, outer edge smooth. Origin of ductus seminalis usually at caudal end of ductus bursae near termination of antrum, sometimes at middle.

Discussion.—At present it is difficult to define this genus in the New World because of insufficient comparative data and a general lack of material, particularly in the case of those species that are known only from one sex. Considerable diversity exist with regard to

venation, and in some instances this may be merely of specific or at most subgeneric significance. It has become obvious as a result of this study that venation by itself frequently cannot be used for generic characterization in this group. Instead, it must be correlated with several other features, such as those found in the male and female genitalia, for proper evaluation. Thus, until both sexes have been studied for all species, certain correlations cannot be made, and several questions will remain unanswered.

In this genus I have considered major venational differences (i.e., the relative origin and fusion of veins) to be primarily of subgeneric importance in association with evidence suggested from other morphological features. I regard the subgenus *Carposina* to be one of the most natural units within the group and have attempted to evaluate and equate the remaining taxa with this one. Several Holarctic species of this subgenus are known, and all demonstrate close affinities to one another. On the basis of such similarity, I have recognized four additional subgroups within the genus, although, for reasons suggested above, future evidence may affect the status of one or more of these subgenera. If one were to follow the criteria accepted by Meyrick (1922), then these four taxa would probably represent an equal number of monotypic genera. Comparisons of the known males, however, show a rather basic genitalic type which appears to relate the various subgroups under the single genus *Carposina*. This is suggested, for example, in a comparison of the males of *C.* (*Carposina*) *niponensis ottawana* and *C.* (*Dipremna*) *cretata*. In contrast, the female genitalia of *C.* (*Hypopremna*) *bullata* does not appear to be closely related to the other species. Thus, it is possible that the male, when discovered, may not possess genitalia of the *Carposina* type, thereby further justifying a separate generic status for this species.

In addition to the nine species of *Carposina* treated in the pages immediately following, two unnamed species are briefly discussed at the end of this paper. Insufficient material is the primary reason why these particular insects have not been identified further.

Key to the Subgenera of *Carposina*

1a. Forewings with all veins arising separate from discal cell (fig. 27) . **Carposina**
1b. Forewings with at least one pair of veins stalked to cell.
  2a. Forewings with veins 8 and 9 stalked to cell.
    3a. Forewings with 3 and 4 stalked (fig. 30) . **Dipremna,** new subgenus
    3b. Forewings with 3 and 4 separate (fig. 31). **Epipremna,** new subgenus
  2b. Forewings with veins 8 and 9 separate.
    3a. Forewings with 7 and 8 stalked (fig. 29); 11 arising at or very near origin of 10 . . . . . **Trepsitypa,** new status
    3b. Forewings with 7 and 8 separate (fig. 33); 11 and 10 widely separate . . . . . **Hypopremna,** new subgenus

Subgenus *Carposina* sensu strictu

TYPE-SPECIES.—*Carposina berberidella* Herrich-Schäffer, 1855.

ADULT.—Forewings (fig. 27) with vein 10 arising from discal cell equidistant between 11 and 9; all veins separate. Hindwings with 6 largely absent, represented by only a faint vestige at end of cell; 3 and 4 typically connate, sometimes stalked for a very short distance with fusion never more than one-sixth the length of 4; discal cell extending approximately one-half the length of wing; 2 arising from outer fifth of cell near origin of 3.

MALE GENITALIA.—Arms of gnathos digitate, moderately stout to slender, occasionally very elongate and exceeding apex of uncus by half their length; setae typically arranged in a single, dense apical or subapical tuft. Valvae distinctly divided into two halves; basal half (sacculus) with a prominent clavate ampulla; apical half (cucullus) usually with apex gradually tapering to a slender curved tip. Juxta bilobed to deeply furcate.

FEMALE GENITALIA.—Ovipositor moderately short to long; posterior apophyses approximately 1.25—2 × the length of anterior pair. Antrum very broad, abruptly constricting to form relatively narrow, elongate ductus bursae; walls of antrum thickened and densely papillose; ductus bursae with papillae more flattened, rounder, and restricted usually to two or three longitudinal bands extending the length of ductus. Corpus bursae typically swollen, ovoid, but more elongate in *C. engalactis;* walls membranous; a pair of strongly furcate signa usually present (absent in *C. engalactis*).

DISCUSSION.—The separate condition of all veins in the forewings easily separates this taxon from the other subgenera of *Carposina*. The group is principally Holarctic in distribution, but presently includes one rather aberrant neotropical species, *C. engalactis*. Unfortunately, this interesting species is known only from the female holotype and has tentatively been placed in the subgenus *Carposina* largely on the basis of venation. Discovery of the male should elucidate its true relationships considerably.

Key to the American Species of the Subgenus *Carposina**

(Based primarily on females)

1a. Female with signa absent . . . . . **C. engalactis**

1b. Female with a pair of furcate signa present (fig. 76).

2a. Ovipositor relatively short; posterior apophyses less than 1.5 × the length of anterior pair (fig. 75). Posterior margin of lamella antevaginalis deeply bilobed.

3a. Posterior margin of lamella antevaginalis with median cleft deep, exceeding length of lobes (fig. 95) . . . **C. biloba,** new species

**C. phycitana* is not included because of insufficient material (see p. 29).

3b. Median cleft of lamella antevaginalis more shallow, less than length of lobes (fig. 94) . . . . . **C. simulator,** new species

2b. Ovipositor elongate; posterior apophyses approximately twice the length of anterior pair (fig. 76). Posterior margin of lamella antevaginalis either shallowly bilobed or with a single median lobe.

3a. Lamella antevaginalis shallowly bilobed (fig. 93). Male with juxta deeply forked (fig. 60) . . . . . **C. fernaldana**

3b. Lamella antevaginalis not bilobed, instead with a single median lobe (fig. 92). Juxta shallowly bilobed, not deeply forked (fig. 59) . . . . . **C. niponensis ottawana,** new status

***Carposina (Carposina) niponensis ottawana* Kearfott, new status**

Figures 3, 4, 59, 74, 92, 110; Map 1

Carposina ottawana Kearfott, 1907b, Canadian Ent., vol. 39, no. 4, p. 124.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180 (no. 7555).—Meyrick, 1922, Gen. Insect., fasc. 179, p. 7.—Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 515.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7625).—Klots, 1942, Bull. American Mus. Nat. Hist., vol. 79, art. 6, p. 416.

Carposina nicholsana Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 515 [new synonymy].—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7626).

Adult (figs. 3–4).—Wing expanse: ♂, 12–15 mm.; ♀, 13–15mm.

Head: Grayish white. Antennae uniformly light gray. Scale tuft of second palpal segment in male strongly projected, acute; lateral and ventral surfaces fuscous, dorsal and inner surfaces of palpus lighter in color, pale gray; second segment in female tending to be darker than that of *C. fernaldana,* usually with dorsolateral scales paler than ventral ones; apex of third segment whitish in both sexes.

Thorax: Light gray with occasional suffusion of dark gray; venter of thorax grayish white. Pro- and mesothoracic legs fuscous; metathoracic leg grayish white; with slight suffusion of fuscous; apices of tibial and tarsal segments whitish. Pattern of forewings variable, similar to *C. fernaldana,* grayish and usually heavily marked with fuscous; darkest concentration along middle of costa and at apex of cell; discal spot generally darker than in following species; dark, transverse band at wing base usually distinct in fresh specimens, tending to be interrupted or obliterated in flown specimens; usually with a faint and narrow, serrate band of light fuscous bordering outer margin. Hindwings uniformly gray.

Abdomen: Light brown above, paler, more whitish beneath; usually with a lateral fuscous streak along basal half of abdomen.

Male genitalia (fig. 59).—Uncus reduced, indistinct, with a dense row of elongate setae arising medially along junction with tegumen. Apex of tegumen concave; lateral angles rather pronounced. Arms of

gnathos slender, greatly elongated, nearly equaling length of valvae, with apex slightly swollen and bearing a dense cluster of short hairs arising from an apical pit. Valvae with a stout, slightly curved ampulla arising near middle from apex of sacculus; cucullus broad at base, tapering to an acute, uncinate apex. Aedeagus with three dense rows of cornuti of about equal lengths and a single, more basal oval patch of short cornuti.

Female genitalia (figs. 74, 92).—Ostium and antrum extremely broad, nearly as wide as seventh segment; lamella antevaginalis with a single, median lobe. Antrum thickened, densely papillose; remainder of ductus bursae narrow, with two broad bands of thickened papillae extending and converging toward corpus. Corpus bursae abruptly enlarged, with two, strongly furcate signa; each branch of signum relatively broad, stout. Inception of ductus seminalis at caudal end of ductus bursae near termination of antrum.

Type.—Lectotype, ♂, (*C. ottawana*) designated by Klots (1942), in the American Museum of Natural History. Lectotype, ♂, (*C. nicholsana*, present designation), Nicholson, Pa., A. E. Lister, VII–4–1904, USNM 69757; in the United States National Museum.

Type-locality.—Ottawa, Canada, (lectotype, *C. ottawana*); Nicholson, Pa. (lectotype, *C. nicholsana*).

Host.—Cornaceae: "reared from fruit of *Cornus paniculata* [=*C. racemosa* Lam.]; Saxifragaceae: Gooseberry [*Ribes* sp.]," (from specimen labels).

Distribution (map 1).—This subspecies ranges rather widely over much of the eastern United States and southern Canada. It has been most commonly encountered along the eastern edge of the Interior Plains and through the southern half of the Appalachian Highlands. The nominal subspecies, *C. niponensis niponensis* Walsingham, occurs throughout Japan and Korea and over much of eastern China and Manchuria (see Anonymous, 1958).

Discussion.—Several problems persist involving this subspecies which emphasize the need for information presently not available. Morphologically *C. niponensis ottawana* is very similar to the typical subspecies. The two forms have been found to differ only in the relative development of the lamella antevaginalis of the female (see figs. 91 and 92) with the posterior margin of the North American subspecies being more attenuated. Unfortunately only a single population of *C. n. niponensis* was available for study; thus it is not known how great a variation the lamella exhibits in this subspecies over its entire range. Six females from Yokohama all demonstrated a rather uniform, slightly curved posterior margin; ten females of *C. n. ottawana*, sampled over much of its known range, displayed slightly more variation but all could be readily distinguished from the

Map 1.—Distribution of *Carposina* (*Carposina*) *niponensis ottawana*.

Japanese specimens. Eventually, other more reliable morphological characters may be found to separate these two entities; or, it may be shown that our North American insect merely represents an early introduction of *C. niponensis*, and that the two names should be synonymized. The correct identity of this insect is of great practical importance because quarantine measures are currently being enacted against the accidental entry of *C. n. niponensis* into this continent. Thus, it is possible that we are needlessly guarding against a pest species that already occurs in the United States. *Carposina n. niponensis*, however, is a major pest of pome fruits over much of the Orient, particularly Japan, and it seems unusual that its counterpart in North America has not attracted equal attention. To my knowledge, *C. n. ottawana* has never been reported as an orchard pest and apparently has never been reared from rosaceous fruits. It would seem that if *ottawana* merely represented a relatively recent introduction of *C. n. niponensis* into this country, then the moth would be an even

more serious pest in the apple and peach growing regions of North America than in Japan since it would, more than likely, be largely devoid of natural enemies. Of course, it is possible that a reverse situation occurred (i.e., with North America being the point of origin) although the early, widespread distribution of the oriental species does not suggest this. Furthermore, *C. n. niponensis* clearly belongs to a Palearctic species group which also includes *C. berberidella* Herrich-Shäffer and *C. scirrhosella* Herrich-Shäffer. Thus, the avilable evidence seems to suggest that the two subspecies actually are distinct, and that they may differ significantly in their biology. Largely for this reason, I have not synonymized *C. n. ottawana*, but prefer to recognize it as a separate subspecies even though present morphological evidence does not fully support such a division.

Another question exists concerning the correct name for the species. The original accounts of both *C. niponensis* Walsingham and *C. sasakii* Matsumura were published July 1900 in different journals, and it now seems impossible to determine which name actually appeared first. Consequently, it is more than likely that article 24a of the International Code of Zoological Nomenclature will need to be consulted in order to determine the proper name. Esaki et al. (1957) briefly discuss this problem, stating their belief that Matsumura's name actually appeared first, but use *C. niponensis* as the correct name for the taxon. Their treatment of these two names perhaps cannot be construed as the action of a "first revisor," but it is possible that an earlier synonymy can be. A majority of the more recent references to this species use Walsingham's name; Lyubarskaya (1964), nevertheless, synonymized *C. niponensis* under *C. sasakii*. There presently seems no doubt that these two names, as well as that of *C. persicana* Matsumura, are synonymous; these problems, however, have not been pursued further by me, in part because of the scope of the present study and particularly in view of Dr. A. Diakonoff's impending revision of the Paleartic Carposinidae.

A third problem encountered involving this species concerns the original publication and subsequent type designation of *C. nicholsana*. Apparently, the first use of this name was by Forbes (1923) in the first part of his "Lepidoptera of New York and Neighboring States." Forbes (p. 515) attributed the name to Kearfott and presented a brief but concise description of the species, listing the locality as Nicholson, Pennsylvania. Since Kearfott's name, however, evidently was only a manuscript one, the authorship of the species should be accredited to Forbes, as was listed by McDunnough (1939). Unfortunately, a search for original material bearing determination labels written by Forbes proved futile. Also, no material from Nichol-

son, Pennsylvania, was found in the collections of Cornell University, although a series of eight specimens with this label are present in the National Museum as well as one in the American Museum. All specimens bear almost identical labels, differing only as to date, and were collected between July 4 and July 12, 1904, by A. E. Lister. Although my decision may appear somewhat arbitrary, I have accepted these nine specimens as being syntypes and have consequently designated one as lectotype and the remainder as paralectotypes. My reasons for this action are several: first it seems almost a certainty, although now cannot be absolutely proven, that Forbes had examined this material prior to the publication of his book and had at least partially based his concept of the species on these specimens. The data on the labels and the absence of any other specimens from the same locality in other collections strongly reinforce this assumption. Furthermore, these specimens are in complete agreement in maculation and size with Forbes' original description.

MATERIAL EXAMINED.—62 males and 34 females.

CANADA: MANITOBA: Aweme, 1 ♀, June 26 (CNC). Morden, 1 ♀, July 10 (CNC). ONTARIO: Bobcaygeon, 3 ♀, June 21–23 (CNC). Ottawa, 1 ♀, June 26 (CNC). Pt. Colborne, 1 ♂, July 20 (CNC). Pt. Pelee, 1 ♂, 2 ♀, June 16–24 (CNC). QUEBEC: Aylmer, 1 ♂, July 7 (CNC). Meach Lake, 1 ♀ (CNC).

UNITED STATES: DISTRICT OF COLUMBIA: Washington, 1 ♂, Aug. 29 (USNM). FLORIDA: Escambia Co.: Pensacola, 1 ♂, July 28 (CPK); 1 ♂, July 28 (USNM). ILLINOIS: Putnam Co.: Specific locality unknown, 1 ♂, May 31, 1 ♂, 3 ♀, June 13–29, 2 ♀, July 10–19, 7 ♂, 1 ♀, Aug. 6–29, 2 ♂, Sept. 6–14 (MOG); 1 ♂, 1 ♀, July 10–16 (USNM). NEW HAMPSHIRE: Rockingham Co.: Hampton, 3 ♂, 4 ♀, May 17–June 16 (AFB). NEW YORK: Tompkins Co.: Geneva, 1 ♂, 1 ♀, Mar. 7 (CU). Ithaca, 17 ♂, 2 ♀, July 2–Aug. 17 (CU); 7 ♂, 1 ♀, July 3–Aug. 23 (USNM), Six Mile Creek, 1 ♂, 1 ♀, June 14–21, 2 ♂, 5 ♀, Aug. 2–19 (JGF). McLean, McLean Bogs Reserve, 3 ♂, July 13–Aug. 1 (JGF). OHIO: Clermont Co.: Specific locality unknown, 1 ♀, June 6 (AFB). OKLAHOMA: Cherokee Co.: Tenkiller Lake, near Cookson, 1 ♀, Aug. 16–19 (USNM). PENNSYLVANIA: Allegheny Co.: Pittsburgh, 1 ♀, June 21 (USNM). Beaver Co.: New Brighton, 1 ♂, June 14 (AMNH). Wyoming Co.: Nicholson, 8 ♂, July 4–12 (USNM); 1 ♂, July 12 (AMNH).

Carposina (*Carposina*) *fernaldana* Busck

FIGURES 5, 28, 39–43, 60, 72–73, 76, 93, 109; MAP 2

Carposina fernaldana Busck, 1907, Journ. New York Ent. Soc., vol. 15, no. 1, p. 36.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180 (no. 7556).—Meyrick, 1922, Gen. Insect., fasc. 179, p. 6.—Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 515, figs. 291, 293; 1928, *in* Leonard, Cornell Univ. Agric. Exp. Sta. Mem. 101, p. 570.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7627).

ADULT (fig. 5).—Wing expanse: ♂, 15–18 mm.; ♀, 16–20 mm.

Head: Grayish white. Antennae uniformly light gray. Second segment of male palpus with prominent rounded scale tuft ventrally,

fuscous along outer and ventral surfaces, whitish on dorsal and inner surfaces; apex of third segment whitish in both sexes; second segment in female usually with ventral half fuscous and dorsal half and most of inner surface whitish, occasionally all of outer side fuscous.

Thorax: Collar and tegula light gray; dorsum light gray, partially irrorated with fuscous; venter largely grayish white. Ventral surfaces of femur of pro- and mesothoracic legs grayish, heavily irrorated with fuscous; dorsal surface grayish white; tibia and tarsus dark fuscous except for whitish bands encircling apices of each segment; metathoracic leg paler in color; femur almost completely pale gray, with a long dorsal fringe of whitish hairs. Forewings pale gray, heavily marked with a somewhat variable pattern of fuscous scales concentrated primarily along middle of costa and near apex of discal cell; dark oblique band traversing base of wing usually incomplete; a submarginal fuscous band often present but diffuse, usually more indented at vein 6 than in *C. niponensis ottawana*; marginal fringe pale gray. Hindwings uniformly gray.

Abdomen: Dorsum and mid-venter pale gray; basal two-thirds of lateroventral surfaces with a broad streak of dark fuscous.

Male genitalia (fig. 60).—Uncus reduced, broadly rounded, with a dense cluster of elongate setae arising from posteromedial margin near juncture with tegumen. Tegumen with apex broadly excavate, lateral angles somewhat pronounced. Gnathos relatively short, less than half the length of valva, with apex spatulate and bearing a dense cluster of elongate setae arising some distance below apex near middle. Valvae with a blunt, claviform ampulla arising from apex of sacculus; cucullus broad at base, tapering to an acute apex. Aedeagus with three longitudinal rows of dense cornuti; one row, bearing the longest apical spines, usually with a conspicuous median gap devoid of spines; juncture of ejaculatory duct above middle; termination of duct with two dense rows of elongate, minute spinules.

Female genitalia (figs. 76, 93).—Ovipositor elongate; posterior apophyses more than twice the length of anterior pair. Lamella antevaginalis of a somewhat complex structure consisting of two pairs of lateral folds, one of which overlaps along the midline, and an entire, bilobed, dorsal layer; lobes rounded and separated by a relatively shallow cleft. Antrum elongate, swollen with thickened, densely papillose walls, becoming abruptly constricted at juncture with ductus bursae proper. Walls of ductus bursae reticulate to and slightly beyond union with corpus bursae, the latter being primarily membranous and containing a pair of strongly furcate signa; each branch of signum relatively slender.

Type.—Lectotype, ♂ (present designation); New Brighton, Pa., 8–23–02, H. D. Merrick, type no. 10245 USNM; ♂ genitalia slide

Map 2.—Distribution of *Carposina* (*Carposina*) *fernaldana*.

DRD 1799; in the United States National Museum.

Type-locality.—New Brighton, Pennsylvania, (lectotype).

Host.—Rosaceae: "*Crataegus* sp., larvae in fruits" (from specimen label). Saxifragaceae: "larvae in nearly ripe currents [*Ribes* sp.]," (Forbes, 1923 p. 515).

Distribution (map 2).—This species is apparently more restricted in its range than is *C. niponensis ottawana* and may be confined largely to the upper Mississippi drainage system in the East. Its present range is known to extend from the southern Appalachian Highlands and the eastern border of the Interior Plains from Quebec west to Missouri.

Discussion.—Because structural differences in the genitalia afford the only reliable separation of this species and the foregoing one, it is sometimes impossible to separate the two species without dissection. Characters of the male genitalia, however, often can be compared *in situ* without any preparation. Other differences exist as mere

generalities and thus cannot be used with any confidence; for example, the palpal tuft in the males of *C. niponensis ottawana* tends to be more pronounced and acute than in *C. fernaldana*. The maculation of the primaries is rather nondescript and variable, although the darkened discal area frequently is more distinct in *C. niponensis ottawana*. Another tendency which may be relied upon at times for separation is the difference in overall size, with *C. fernaldana* being slightly larger on the average.

In addition to the lectotype, I have also designated five male and two female paralectotypes from Pittsburgh and Oak Station, Pennsylvania, and St. Louis, Missouri. All specimens are deposited in the collections of the U.S. National Museum. The original syntypic series undoubtedly was much larger and many of these specimens are still extant in United States National Museum; for example, the National Collection contains eleven additional specimens from St. Louis collected in 1906 by McElhose which probably comprised a fundamental part of Busck's original series; however, I have selected as paralectotypes only those few specimens which bore either a type or cotype label.

Material examined.—88 males and 102 females.

CANADA: Ontario: Fort Erie, 1 ♂, Aug. 22 (CU). Islington, 1 ♂, 3 ♀, July–Aug. (USNM). Swaison, 1 ♂, Aug. (USNM). Simcoe, 4 ♂, 6 ♀, Aug. 18 (CNC). Toronto, 1 ♂, July 20 (USNM). Vineland Station, 6 ♂, 4 ♀, Aug. 3–19 (CNC). Quebec: Montreal, 1 ♀, Aug. 11 (AFB); 7 ♂, 10 ♀, Aug. 9–11 (CNC); 1 ♂, 2 ♀, Aug. 9–11 (USNM).

UNITED STATES: Illinois: Cook Co.: Arlington Heights, 3 ♂, 2 ♀, Aug. 18–26 (CMNH); Chicago, 1 ♂ [no date] (USNM); Riverside, 1 ♂, 1 ♀, Aug. 9–20 (USNM). Macon Co.: Decatur, 6 ♂, 5 ♀, Aug. 16–22 (USNM). Putnam Co.: Specific locality unknown, 5 ♀, Aug. 15–Sept. 9 (MOG). Michigan: Wayne Co.: Specific locality unknown, 1 ♂, Aug. 13 (AMNH). Missouri: Boone Co.: Columbia, 1 ♂, Apr. 14 (USNM); 1 ♀, June 15 (CU). St. Louis Co.: St. Louis, 3 ♂, Sept. 10–14 (AMNH); 8 ♂, 4 ♀, Aug. 29–Sept. 18 (USNM). New York: Chemung Co.: Horseheads, 1 ♀, Sept. 23 (CU). Erie Co.: Buffalo, 2 ♂, Aug. 4–23 (CU). Colden, 1 ♀, Aug. 19 (CU). East Aurora, 2 ♂, 1 ♀, Aug. 12–16 (CU). Sardinia, 2 ♀, Aug. 11–28 (CU). Tompkins Co.: Ithaca, 5 ♂, 11 ♀, July 21–Sept. 16 (CU); 1 ♂, Aug. 22 (USNM). Ithaca, Six Mile Creek, 1 ♂, 16 ♀, Aug. 4–26 (JGF). Ohio: Hamilton Co.: Cincinnati, 1 ♂, Aug. 24 (AFB). Pennsylvania: Allegheny Co.: Oak Station, 3 ♀, Aug. 15 (AFB); 16 ♂, 15 ♀, Aug. 8–31 (AMNH); 1 ♂, Aug. 19 (USNM). Pittsburgh, 2 ♂, Aug. 26 (AMNH); 3 ♂, 1 ♀, Aug. 11–26 (USNM). Beaver Co.: New Brighton, 2 ♂, 1 ♀, Aug. 21–Sept. 2 (AFB); 4 ♂, Aug. 16–23 (AMNH); 1 ♀, June 12, 4 ♂, 4 ♀, Aug. 14–Sept. 13 (USNM). Luzerne Co.: Hazleton, 1 ♀, June 5 (AMNH).

***Carposina* (*Carposina*) *simulator*, new species**

Figures 6, 77, 94, 111; Map 3

Adult (fig. 6).—Wing expanse: ♀, 15 mm.

Head: Whitish with slight irroration of pale brown. Antennae with scape mostly dull white, faintly irrorated with brown; shaft

uniformly brown except for scattering of white along basal fourth. Labial palpus pale brown with heavy suffusion of fuscous on lateral surface; inner surface mostly pale tan to dull white.

Thorax: Whitish to light brown with irregular scattering of brownish to fuscous scales; ventral surfaces dull white. Pro- and mesothoracic legs fuscous on ventral surfaces and dull white on dorsal surfaces; mesothoracic tibia with broad ring of white around middle; metathoracic leg pale fuscous to light brown; apices of tibial and tarsal segments all faintly ringed with white. Forewings pale gray to pale brown, irregularly mottled with darker areas of brown and fuscous; costa with six or seven fuscous patches, broadest at base of wing and becoming progressively narrower toward apex, each patch being interrupted by a narrow band of grayish white; apex of discal cell with an irregular concentration of fuscous to black scales, marginal fringe brownish, heavily irrorated with white. Hindwings gray, becoming darker at outer third.

Abdomen: Light brown above and below.

Female genitalia (figs. 77, 94).—Ovipositor relatively short; posterior apophysis approximately 1.5 × the length of anterior pair. Antrum broad and elongate, with walls heavily thickened and papillose; posterior margin of lamella antevaginalis complex, deeply excavated and bilobed, both lobes doubly thickened by inward folding of posterior margin; a prominent V-shaped fold typically present near center of lamella. Walls of ductus bursae mostly thickened; reticulate pattern arranged in four longitudinal bands that extend the length of ductus and converge near corpus. Corpus bursae abruptly enlarged, membranous, with a pair of deeply forked signa. Ductus seminalis connected to caudal end of ductus bursae near termination of antrum.

Holotype.—Devil's Den State Park, Washington County, Ark., ♀, July 21, 1966, coll. R. W. Hodges, USNM 69650; in the United States National Museum.

Paratypes.—missouri: St. Louis Co.: St. Louis, 1 ♀, Aug. 30, 1963, coll. H. McElhose (USNM). ohio: Hamilton Co.: Cincinnati, 1 ♀, Aug. 28, 1902, coll. A. F. Braun (AFB). Described from a total of three females.

Host.—Unknown.

Distribution (map 3).—Presently known only from the southeastern border of the Interior Plains from northeastern Arkansas to southeastern Ohio.

Discussion.—Although this species at present is represented by only three female specimens, it is quite distinct from all other Carposinidae and may be easily recognized utilizing certain characters of the female. Superficially, *Carposina simulator* most closely resembles *C. fernaldana* and *C. biloba* but may be distinguished from the

latter two on the basis of morphological differences of the lamella antevaginalis. The posterior margin of the lamella is deeply bilobed in *C. simulator*, whereas in *C. fernaldana* there exists only a shallow notch. Furthermore, each lobe is doubly thickened by an additional fold of the lamella. In *C. biloba*, the posterior margin is of a more simple structure and appears to consist of a single layer of tissue.

Carposina (Carposina) biloba, new species

FIGURES 7, 75, 95, 112; MAP 3

ADULT (fig. 7).—Wing expanse: ♀, 17mm.

Head: Pale gray. Antennae uniformly pale gray. Labial palpi grayish white with lateroventral surfaces heavily covered with fuscous; apex of both second and third segments white; third segment completely encircled by a fuscous band.

MAP 3.—Distribution of *Carposina* species.

● *C. (Carposina) simulator* ★ *C. (Carposina) biloba*

Thorax: Collar and dorsum pale gray; costal edge of tegula darker gray; underside of thorax grayish. Pro- and mesothoracic legs mostly fuscous with grayish suffusion on mediodorsal surfaces; apices of tibial and tarsal segments white; metathoracic leg distinctly paler, mostly pale gray with long white hairs along dorsal edge of femur; tibial and tarsal segments mostly gray with medial bands of fuscous. Forewings grayish white with scattered areas of brownish fuscous scales; discal spot and basal oblique band obscure, about same color as rest of wing; outer fringe pale gray, irrorated with white. Hindwings uniformly gray.

Abdomen: Medium gray above and below.

Female genitalia (figs. 75, 95).—Ovipositor moderately short; posterior apophysis approximately 1.5 × length of anterior pair. Ostium and antrum broad, equal to width of seventh segment; lamella antevaginalis simple, bilobed; lobes sharply separated by a deep cleft nearly twice the length of either lobe. Walls of antrum and ductus bursae thickened and densely papillose; papillae restricted along most of ductus to two broad, longitudinal bands. Corpus bursae abruptly enlarged, membranous, with a pair of deeply forked signa. Juncture of ductus seminalis at caudal end of ductus bursae near termination of antrum.

Holotype.—Pensacola, Fla., ♀, July 28, 1961, coll. Shirley Hills, USNM 69651; in the United States National Museum.

Host.—Unknown.

Distribution (map 3).—Known only from the type-locality, which is situated in the East Gulf Section of the Gulf Coastal Plain of northeastern Florida.

Discussion.—This species, although presently represented only by the unique female, is morphologically distinct from all other members of the genus. It may be separated most easily from *Carsina fernaldana* and *C. simulator*, which it apparently bears closest affinities to, by the relatively simple, deeply clefted, bilobed lamella antevaginalis.

Carposina (*Carposina*) *engalactis* Meyrick

Figures 8, 79, 96; Map 4

Carposina engalactis Meyrick, 1932, Exotic Microlepidoptera, vol. 4, pt. 10, p. 313.

Adult (fig. 8).—Wing expanse: ♀, 18–19 mm.

Head: Uniformly whitish to pale stramineous. Antennae same color as head. Labial palpus mostly whitish, with slight suffusion of fuscous on lateroventral margin; apical segment mostly whitish, ringed with pale brown.

Thorax: Collar and tegula approximately same color as head; dorsum slightly darker, stramineous; underside of thorax stramineous.

313-145 O—68——3

Legs with lateroventral scales mostly fuscous, dorsal scales whitish to stramineous; apices of tarsal segments ringed with white; tibia of meso- and metathoracic legs with broad band of white, remainder of segment fuscous. Forewings stramineous, irregularly mottled with various shades of brown; darker areas concentrated in four or five brownish fuscous spots along costa, at apex of cell and along termen; border of termen slightly darker with two or three dark fuscous, submarginal spots; outer fringe mostly unicolorous, stramineous. Hindwings uniformly pale gray.

Abdomen: Uniformly pale stramineous above and below.

Female genitalia (figs. 79, 96).—Ovipositor relatively short; posterior apophysis approximately 1.5 × length of anterior pair. Posterior margin of lamella antevaginalis sinuate, with a shallow median depression. Antrum greatly swollen, globose, somewhat constricted near ostium; walls thickened and densely papillose throughout. Walls of ductus bursae somewhat thickened, reticulate, gradually becoming more membraneous toward corpus; ductus gradually enlarging to form relatively elongate, slender bursa; signa absent. Inception of ductus seminalis at caudal end of ductus bursae near termination of antrum.

Type.—Lectotype, ♀ (present designation); Santa Catharina [sic], Neu-Bremen, Fr. Hoffmann, 23.II.31; *Carposina engalactis*, n.sp., det. Meyrick, Type. In the Vienna Naturhistorisches Museum.

Type-locality.—Neu Bremen, Santa Catarina, Brazil.

Host.—Unknown.

Distribution (map 4).—Known only from the type-locality, which is situated in the Paraná Plateau of southeastern Brazil.

Discussion.—Certain morphological features of this species, such as the absence of a signum, suggest a generic or subgeneric placement different than the one currently recognized. All other females of the subgenus *Carposina* studied, including the type of the genus, are characterized by a pair of strongly forked signa. Unfortunately, no males are yet known of *C. engalactis;* thus, it is possible that the discovery of a male will necessitate a new combination for this species. The venation of the forewing, however, agrees with typical *Carposina* in that all veins arise separately from the cell.

Through the courtesy of Dr. Fritz Kasy of the Vienna Museum, I was able to examine two of the three syntypes described by Meyrick and have designated one as lectotype. The present location of the third specimen is not known.

Material examined.—Two females.

SOUTH AMERICA: Brazil: Santa Catarina, Neu Bremen, 1 ♀, lectotype, 1 ♀, paralectotype, Feb. 23, 1931, coll. Fr. Hoffman (VNM).

***Carposina (Carposina) phycitana* Walsingham**

FIGURE 9; MAP 5

Carposina phycitana Walsingham, 1914, Biol. Centrali-Americana, Heterocera, vol. 4, p. 299, pl. 9. fig. 9.—Meyrick, 1922, Gen. Insect., fasc. 179, p. 7.

The following is quoted from the original description: "*Antennae* strongly biciliate 4; shining, whitish. *Palpi* fawn-whitish. *Head* straw-whitish. *Thorax* shining, pale fawn. *Forewings* shining, pale fawn-ochreous, mottled with fawn-brown, of which the most conspicuous markings are an elongate patch on the end of the cell, and a shade along the termen, three or four fuscous spots on the outer half of the costa, and three before the terminal shade above mentioned; some shining, silvery white scales are scattered about the wing-surface, before and beyond the middle, and several patches of strongly-raised scales conform to the ground-colour on which they arise—two of these are near the base, above the fold, two below the basal half of the fold, one immediately above the middle of the fold, and one at the end of the cell; cilia fawn-whitish. *Exp. al.* 17 mm. *Hindwings* rosy grey; cilia paler. *Abdomen* shining, pale grey. *Legs* fawn-whitish, with greyish tarsal bands.

"*Type* ♂ (66307) Mus. Wlsm. (Godm-Salv. Coll.) BM.

"*Hab.* Panama: Chiriqui: Volcan de Chiriqui, 2000–3000 ft., 1881–2 (G. C. Champion). Unique.

"This is a true *Carposina*, with typical neuration: (*Forewings* 12 veins, all separate; 2 from near angle of cell, 7 to termen. *Hindwings*, cubitus pectinate; 6 veins, (3+4) and (6+7) coincident; (3+4) and 5 short-stalked)."

DISCUSSION.—Unfortunately, it was not possible for me to examine the unique holotype of this species, although it is doubtful that much information can be obtained from that specimen due to its present physical condition. Mr. Paul Whalley of the British Museum has informed me that the holotype is now in extremely poor condition, having no abdomen and only one pair (left side) of wings. Consequently, I have included in full the original description of the species above, realizing, of course, that relatively little use can be derived from this superficial diagnosis due to its omission of genital characters. It is doubtful whether the identity of this species can ever be established until additional material is rediscovered from the type-locality.

Only two other specimens of *Carposina* are presently known from Central America, and neither of these is believed to be conspecific with *C. phycitana*. These two moths are discussed toward the end of this paper as *Carposina* species numbers 1 and 2.

Subgenus *Trepsitypa* Meyrick, new status

Trepsitypa Meyrick, 1913 Exotic Microlepidoptera, vol. 1, pt. 3, p. 72; 1922, Gen. Insect., fasc. 179, pp. 2, 3.—Clarke, 1963, Catalogue of the type specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick, vol. 4, p. 65.

Type-species.—*Trepsitypa cardinata* Meyrick, 1913. Original designation and monobasic.

Adult.—Forewings (fig. 29) with vein 10 arising from discal cell at or very near origin of 11; 7 and 8 stalked for approximately half their length; 3 and 4 stalked less than half their length. Hindwings with 6 faintly present; discal cell shortened, extending less than half the length of wing; 2 arising from outer fourth of cell.

Female genitalia.—Ovipositor relatively long and slender; posterior apophyses approximately twice the length of anterior pair. Antrum and ductus bursae with thickened, densely papillose walls extending entire length to corpus. Corpus bursae completely membranous, with a pair of deeply forked signa.

Discussion.—The stalked condition of veins 7 and 8 in the primaries immediately separates this subgenus from the other members of *Carposina* as well as from all other genera of the family.

Carposina (*Trepsitypa*) *cardinata* (Meyrick), new combination

Figures 10, 29, 78, 97, 115; Map 4

Trepsitypa cardinata Meyrick, 1913, Exotic Microlepidoptera, vol. 1, pt. 3, p. 73; 1922, Gen. Insect., fasc. 179, p. 3.—Clarke, 1963, Catalogue of the type specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick, vol. 4, p. 65, pl. 31, figs. 1a–e.

Adult (fig. 10).—Wing expanse: ♀, 14 mm.

Head: Whitish with slight admixture of fuscous scales. Antennae whitish, each segment encircled by a narrow band of fuscous. Labial palpi light fuscous, majority of scales with darker tips; apices of second and third segments whitish.

Thorax: Whitish with slight suffusion of fuscous; concentration of fuscous along collar, becoming heavier on tegula; undersides of thorax mostly whitish. Legs mostly whitish ochreous below, fuscous above except for a whitish band encircling apices of tibial and tarsal segments; metathoracic leg distinctly paler in color. Forewings pale brown with somewhat irregular suffusion of dark fuscous markings concentrated at wing base, costa, and at outer margin of discal cell; transverse band at wing base fuscous, outer fourth of wing largely whitish; marginal fringe mostly grayish. Hindwings uniformly grayish.

Abdomen: Pale fuscous to gray above and below, slightly paler on underside.

Female genitalia (figs. 78, 97).—Lamella antevaginalis with surface roughened, densely papillose; posterior margin very irregular, consisting of a double fold of heavy membrane, slightly projected caudad near middle. Ductus bursae relatively enlarged, approximately same width as antrum throughout most its length; walls densely papillose to junction with corpus bursae, papillae becoming flattened

Map 4.—Distribution of *Carposina* species and *Atoposea*.

☆ *C.* (*Carposina*) *engalactis* ★ *C.* (*Hypopremna*) *bullata*
● *C.* (*Trepsitypa*) *cardinata* ▲ *Atoposea maxima*

and broader (i.e., reticulate) toward lower end. Corpus bursae abruptly enlarged; rami of signa relatively long and slender.

TYPE.—Lectotype, ♀ designated by Clarke (1963), in the British Museum (Natural History).

TYPE-LOCALITY.—Bartica, Guyana.

DISTRIBUTION (map 4).—Known only from the type-locality which is located in the Guiana Coastal Plain.

DISCUSSION.—Superficially this subgenus and species closely resemble the members of the typical subgenus, particularly in the general structure of the female genitalia. The palpus of the lectotype as figured by Clarke and of the paralectotype examined by me both show less scaling along the dorsum of the second palpal segment; however, this condition is probably due to the rather poor preservation of these two specimens. The diagnostic feature of the subgenus as well as the species is the stalking of veins 7 and 8 in the primaries; *Trepsitypa* being the only carposinid possessing this character.

MATERIAL EXAMINED.—One female.

SOUTH AMERICA: GUYANA: Bartica, 1 ♀, 12.12 [December], paralectotype, coll. Parish (USNM).

Subgenus *Dipremna*, new subgenus

TYPE-SPECIES.—*Carposina cretata*, new species.

ADULT.—Forewings (fig. 30) with vein 10 arising from discal cell slightly closer to 11 than to 9; 8 and 9 stalked less than one-third their length; 3 and 4 stalked approximately one-third their length. Hindwings with 6 completely absent; discal cell relatively shortened, less than half the length of wing; 2 arising from outer third of cell.

MALE GENITALIA.—Uncus present but reduced. Tegumen relatively broad; lateral margins with a prominent, elongate and widely divided gnathos. Transtilla weak, with a pair of digitate processes arising near lateral ends. Valvae variously lobed, broad at base, narrowing abruptly to apex; ampulla reduced, arising from base of costa. Vinculum rather weak, expanding ventrally to form distinct saccus. Juxta prominent, furcate. Aedeagus with apical half expanded, cornuti numerous and arranged in two dense clusters; inception of ejaculatory duct just below middle.

DISCUSSION.—This taxon can be easily separated from the other subgenera of *Carposina* by the two sets of stalked veins, 3+4 and 8+9, in the primaries; hence the name *Dipremna* (double-stalk). The male genitalia of *C. cretata* is structurally very close to that observed in the species of the typical subgenus, particularly in the form of the juxta and gnathos.

***Carposina (Dipremna) cretata*, new species**

FIGURES 13, 30, 61; MAP 5

ADULT (fig. 13).—Wing expanse: ♂, 14–15 mm.

Head: White except for slight suffusion of fuscous along front rim of eye. Antennae with scape and pedicel white; basal 6–8 segments irregularly ringed with brownish fuscous, becoming entirely brownish fuscous beyond. Labial palpi white, heavily irrorated with fuscous on outer side; apical segment with slight suffusion of pale brown around middle.

Thorax: Whitish with suffusion of pale to medium brown; tegula pale brownish at base, apical half white; dorsum heavily suffused with brown; venter of thorax whitish. All legs whitish dorsally, darker ventrally; tarsal segments whitish tipped; pro- and mesothoracic legs fuscous below, metathoracic leg paler, brownish. Forewings largely white, with sparsely scattered patches of pale brown to fuscous; basal transverse band pale fuscous, interrupted with white at middle; four or five fuscous spots of varying widths along costa, typically two broad and two narrow spots alternately spaced; most of outer third of discal cell dark fuscous, partially continuing as an oblique streak to outer third of costa; termen usually with six small fuscous spots placed at apex of veins; fringe whitish, suffused with pale gray to brown. Hindwing grayish white to silvery gray, darker at apex.

Abdomen: Pale fuscous to dusky white above, usually darker laterally and paler, more whitish beneath.

MALE GENITALIA (fig. 61).—Uncus triangular, lightly sclerotized. Tegumen with a dense, transverse row of broad setae across middle; both halves of gnathos elongate, sinuate, terminating in a long, stout spine; a long strand of fine hairs enclosed in and extending the length of each shaft and projecting slightly beyond subapical aperature. Transtilla consisting of a thin, narrow band, becoming broader at lateral juncture to valvae, with a pair of strongly curved, digitate processes arising near valvae. Juxta elongate, approximately one-half length of valvae, strongly forked almost to base. Valvae with relatively broad base, abruptly constricted at outer third; apical third slender, tubular, strongly curved, gradually flaring at apex. Vinculum narrow, Y-shaped, gradually enlarging to form short but distinct saccus. Aedeagus with apical half enlarged, asymmetrical, partially excavate on one side; with a large, rather elongate patch of over 30 stout spines projecting basad; a small, subapical patch of about six to eight shorter spines just above large patch.

HOLOTYPE.—El Yunque Biological Station, Molindero Road, Luquillo Forest, 2100 feet, Puerto Rico, ♂, Jan. 17, 1963, coll. P. J. Spangler, at black light, USNM 69653; in the United States National Museum.

Paratypes.—Puerto Rico: Same locality as holotype, 5 ♂, Jan. 11–17, 1963, coll. P. J. Spangler (USNM). Described from a total of six males.

Host.—Unknown.

Distribution (map 5).—Known only from the type-locality.

Discussion.—Superfically this species may be distinquished from the other members of *Carposina* by its predominantly whitish color. The male genitalia show many diagnostic features, particularly in the unique structure of the valvae and gnathos. In addition, the stalking of both 3+4 and 8+9 in the primaries can be utilized as a specific character as well as a subgeneric one. The venation of all six specimens was examined and no variation was observed.

The discovery of *C. cretata* now establishes the presence of at least two species of Carposinidae in Puerto Rico, the other species being *C. bullata*.

Subgenus *Epipremna*, new subgenus

Type-species.—*Carposina dominicae*, new species.

Adult.—Forewing (fig. 31) with vein 10 arising from discal cell nearer to 11 than to 9; all veins separate except 8 and 9 which are stalked one-third their length. Hindwings with only a vestige of 6 present at outer margin of cell; 3 and 4 usually connate; sometimes slightly separate; discal cell relatively shortened; slightly less than half the length of wing; 2 arising from outer fifth of cell very near 3.

Male genitalia.—Uncus present, but reduced in size. Tegumen relatively broad. Lateral arms of gnathos widely separated, elongate and stout. Transtilla reduced to a thin band across middle; broader laterally; a pair of digitate processes present near juncture with valvae. Valvae relatively simple; ampulla absent. Vinculum rather weak, expanding ventrally to form broad, indistinct saccus. Juxta strongly bilobed. Aedeagus with apical half expanded; a single, dense cluster of cornuti present near apex; juncture of ejaculatory duct above middle.

Female genitalia.—Ovipositor relatively short; posterior apophyses approximately 1.5 × length of anterior pair. Lamella antevaginalis relatively simple, reduced. Antrum distinct, walls densely papillose. Ductus bursae slender, gradually enlarging to form long, narrow corpus. Corpus bursae membranous, without signa.

Discussion.—On the basis of venation, particularly in regard to the stalking of 8+9 and the separation of all other veins of both wings, this taxon can be easily distinguished from the remaining subgenera of *Carposina* and from most other Carposinidae. It is probably closest to *Meridarchis* with regard to venation, but differs from the type of that genus in several features of the secondaries, such as: the near

absence of vein 6, the connate condition of 3 and 4, and the distal origin of 2 which arises near 3. In addition, the male genitalia of *Carposina* and *Meridarchis* exhibit several basic differences described below.

***Carposina* (*Epipremna*) *dominicae*, new species**

FIGURES 11–12, 31, 62, 80, 98, 114; MAP 5

ADULT (figs. 11–12).—Wing expanse: ♂, 14–15 mm.; ♀ 14–16 mm.

Head: Whitish. Antennae whitish at base, becoming grayish to pale fuscous along middle of shaft, then whitish again at apex; sensory hairs of male 5–6 × diameter of shaft in length; those of female about 0.5 ×. Labial palpus in male with basal third of second segment fuscous, remainder of segment and all of third whitish; female with basal third and most of ventral surface of second segment fuscous, remainder of segment and all of third tawny to whitish.

Thorax: Whitish to pale brown; venter mostly whitish. Pro- and mesothoracic legs whitish to pale gray, apices of tibial and tarsal segments faintly tufted with whitish to tawny scales. Forewings light brown, irregularly mottled with dark brown and fuscous; typically four or five fuscous spots of varying widths distributed along costa; basal spot of series the broadest, situated just below middle of costa; apex of discal cell with either one or two small but prominent fuscous tufts of raised scales; marginal fringe grayish to pale brown, faintly irrorated with dusky white. Hindwings grayish, outer third slightly darker.

Abdomen: Whitish to tawny above, slightly darker beneath with a greater suffusion of pale fuscous.

MALE GENITALIA (fig. 62).—Uncus reduced, consisting of a simple rounded lobe, indistinctly separated tegumen, with a transverse row of several elongate setae arising near base. Tegumen a relatively broad dorsal arch. Gnathos, divided, very prominent and stout, nearly as long as valvae, with a dense cluster of elongate spines extending from the base of each element to beyond its apex. Transtilla mostly membranous across middle, expanding laterally to form a small rectangular sclerite; lateral digitate processes very short, approximately 3 × as long as broad; setose. Valvae relatively simple, without ampulla; broad at base, becoming strongly constricted near middle, then enlarging into a densely spinulose, evenly rounded cucullus. Juxta broad, irregularly bilobed and constricted at middle. Vinculum V-shaped, narrow; saccus moderately developed, indistinctly set off from vinculum. Aedeagus with apical half enlarged, strongly asymmetrical, curved slightly toward midline, bearing a dense, longitudinal cluster of more than 50 spines; approximately half of apical area membranous; basal half narrow, rodlike.

Map 5.—Distribution of *Carposina* species.

▲ *C.* (*Carposina*) *phycitana* ■ *Carposina* species, no. 1
★ *C.* (*Dipremna*) *cretata* ☆ *Carposina* species, no. 2
● *C.* (*Epipremna*) *dominicae*

Female genitalia (figs. 80, 98).—Lamella antevaginalis largely membranous but papillose and somewhat thickened; posterior margin membranous, irregular; a pair of knoblike thickenings present near posterolateral angles. Antrum inflated; walls thickened; papillose to reticulate. Ductus bursae narrow, becoming gradually enlarged toward corpus bursae; walls partially membranous, with three or four longitudinal bands of reticulate thickenings extending length of ductus and gradually disappearing toward corpus. Corpus bursae completely membranous, elongate, gradually enlarging toward terminal end. Origin of ductus seminalis at caudal end of ductus bursae near termination of antrum.

Holotype.—Two miles N.W. Pont Cassé, 1400 feet, Dominica, British West Indies, ♂, April 27, 1965, coll. D. R. Davis, USNM 69652; in the United States National Museum.

Paratypes.—Dominica: Freshwater Lake, 2400 feet, 1 ♂, Nov. 8, 1966, coll. E. L. Todd (USNM). Point Lolo, 5 mi. W. of, 1500 feet, 1 ♂, 2 ♀, Feb. 19–Mar. 1, 1965, coll. J. F. G. Clarke (USNM). Pont Cassé, 2000 feet, 2 ♂, 4 ♀, Apr. 2–May 19, 1965, coll. D. R. Davis (USNM); 0.5 mi. W. of, 1 ♂, 2 ♀, July 22–24, 1963, coll. O. S.

Flint (USNM); 1.5 mi. N.W. of, 1500 feet, 2 ♀, Apr. 3, 1965, coll. D. R. Davis (USNM); 2 mi. N.W. of, 1400 feet, 4 ♂, 34 ♀, Apr. 13–June 5, 1965, coll. D. R. Davis (USNM). Described from a total of 9 males and 44 females.

Host.—Unknown.

Distribution (map 5).—This species is known only from Dominica of the Lesser Antilles, where it commonly occurs in the wetter and more heavily forested central area of the island at elevations from 1400 to 2400 feet.

Discussion.—Several features of the male and female genitalia and wing venation distinguish this species from all other members of the genus. The absence of a signum in the female and the stalking of 8+9 in the primaries are not unique considered separately, but are of particular significance when associated.

Carposina dominicae was most commonly encountered by the author in pure stands of rain forest above 1400 feet. It is probably significant that the species was never collected in the heavily cut, replanted areas at lower elevations, as exist at the Clarke Hall Estate, even though such locations were rather thoroughly sampled by various members of the Bredin-Archbold-Smithsonian Biological Survey.

Subgenus *Hypopremna*, new subgenus

Type-species.—*Carposina bullata* Meyrick, 1913.

Adult.—Forewings (fig. 33) with vein 10 originating distinctly closer to 11 than 9; all veins arising separate from discal cell except 3 and 4 which are stalked for approximately half their length. Hindwings with 6 faintly present; 3 and 4 normally connate, sometimes stalked for a short distance with fusion never more than one-sixth the length of 4; discal cell shortened, extending less than half the length of wing; 2 arising from outer fourth of cell.

Female genitalia.—Ovipositor moderately long and slender; posterior apophyses approximately 1.5 × length of anterior pair. Antrum and ductus bursae of relative uniform diameter, with heavily thickened, reticulate walls extending entire length to corpus, thence terminating abruptly. Corpus bursae completely membranous, enlarged and rounded, with a pair of furcate signa.

Discussion.—*Hypopremna*, which literally means "lower stalk," may be separated from the other subgenera of *Carposina* by the stalking of veins 3 and 4 of the forewing and the separate condition of all other veins.

Carposina (*Hypopremna*) *bullata* Meyrick

Figures 14, 33, 81, 99; Map 4

Carposina bullata Meyrick, 1913, Exotic Microlepidoptera, vol. 1, pt. 4, p. 98; 1922, Gen. Insect., fasc. 179, p. 7.—Clarke, 1963, Catalogue of the type

specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick, vol. 4, p. 42, pl. 20, figs. 2–2c.

Adult (fig. 14).—Wing expanse: ♀, 11–13 mm.

Head: Whitish to light brown. Antennae unicolorous, light brown to pale fuscous. Labial palpi fuscous, slightly irrorated with light brown; dorsal scales and extreme apices of second and third segments light brown; inner surface of second segment mostly whitish to light brown.

Thorax: Whitish to light brown, scale apices often of a lighter color than base; venter of thorax paler, usually whitish. Pro- and mesothoracic legs fuscous; apices of tibial and tarsal segments whitish to light brown; metathoracic legs whitish, faintly irrorated with pale brown. Forewings mottled with various shades of brown; basal transverse band of fuscous present; five fuscous spots usually distinguishable along costa; a rather large, elongate, fuscous spot covering outer half of discal cell usually distinct even in rubbed specimens; marginal fringe fuscous, scales tipped with light brown to dusky white. Hindwings grayish at base, becoming darker toward outer margin.

Abdomen: Light brown to tawny above, more whitish beneath.

Female genitalia (figs. 81, 99).—Lamella antevaginalis lightly sclerotized, variable in outline, roughly triangular; posterior margin usually sinuate, with a slight median depression, nearly truncate in some forms and more projected posteriorally in others. Ductus bursae and antrum indistinguishable, of approximately same diameter throughout length, becoming slightly enlarged toward corpus; walls heavily reticulate. Corpus bursae abruptly enlarged, spherical; juncture with ductus bursae sharply delineated by abrupt termination of thickened walls of ductus; furcate arms of signa relatively short; one arm of each signum frequently subdivided to form a short secondary fork. Inception of ductus seminalis below middle of ductus bursae.

Type.—Holotype, ♀; in the British Museum (Natural History).

Type-locality.—Bartica, Guyana.

Host.—Unknown.

Distribution (map 4).—Present records, although scattered, suggest this neotropical species to be rather widely distributed. It is known to occur from the Dominican Republic south through the Lesser Antilles to Guyana; it has also been found in Peru. The largest series of *Carposina bullata* collected thus far is from Dominica where it is found over much of the wetter parts of the island from near sea level to elevations exceeding 2,000 feet.

Discussion.—The female genitalia of this species appears quite different from that of the other members of the genus. After the male is discovered and more information thus made available, it may become necessary to recognize this taxon as a separate genus. The

venation of *Carposina bullata* appears very stable; 15 specimens were examined for venational variation, and no appreciable differences were noted from the pattern as shown in figure 33.

MATERIAL EXAMINED.—21 females.

PERU: Iquitos, 1 ♀, Mar. 21 (BM).

WEST INDIES: DOMINICA: Antrim, 1,000 feet, 1 ♀, Mar. 11 (USNM); Central Forest Reserve, 1 ♀, May 8 (USNM); Clarke Hall Estate, 1 mi. E., 5 ♀, Apr. 4–May 22 (USNM); Pont Cassé, 2,000 feet, 1 ♀, May 19 (USNM); 2 mi. N. W. Pont Cassé, 1,400 feet, 2 ♀, Apr. 16–May 5 (USNM); Rosalie, 1 ♀, June 15 (USNM); South Chiltern Estate, 1 ♀, Mar. 3 (USNM). DOMINICAN REPUBLIC: San Francisco Mts., 6 ♀, Sept. (USNM). PUERTO RICO: Bayamon, 1 ♀, Sept. 10 (USNM). TRINIDAD: Specific locality unknown, 1 ♀ (USNM).

Atoposea, new genus

TYPE-SPECIES.—*Carposina maxima* Meyrick, 1912a.

ADULT.—Moderately robust, medium size moths; wing expanse approximately 35 mm.

Head: Antennae of male with short, relatively broad scales restricted to dorsal and lateral surfaces; ventral surface with two rows of dense, minute cilia; cilia moderately long, length approximately 1–1.5 × diameter of shaft.

Thorax: Wings (fig. 34) relatively broad, termen not strongly oblique. Forewings with all veins arising separate from discal cell; vein 10 originating considerably closer to 11 than to 9; apex of cell slightly excavate. Hindwings with 6 present; discal cell extending approximately one half the length of wing; vein 2 arising from middle of cell.

MALE GENITALIA.—Uncus present but reduced. Tegumen relatively broad. Gnathos elongate, widely separated into two symmetrical halves. Subscaphium present. Transtilla weak, with a pair of digitate processes arising from lateral ends. Valvae elongate, with ampulla present. Vinculum reduced to a narrow ventral ring; saccus small, not extended. Aedeagus with apical half slightly enlarged; cornuti numerous, minute, restricted primarily to two lateral rows; inception of ejaculatory duct approximately midway along aedeagus.

DISCUSSION.—Superficially, the venation of this genus resembles that of certain members of *Carposina*, particularly the typical subgenus, but a combination of what may appear to be relatively minor differences do exist. Notably among these are the origin of vein 10 in the forewing, the distinct presence of 6 and the origin of vein 2 in the hindwing. In regard to the last character, the second cubital vein originates more distad near the lower angle of the cell than in all members of *Carposina*. *Atoposea*, which literally means "odd" or "unusual moth," may be further separated from the other New World

members of the family by the distinctly different male genitalia; particularly by the presence of a subscaphium. The male genitalia of *A. maxima* superficially resembles that of some species of *Heterogymna* and *Meridarchis* but differs, again, by the presence of a subscaphium. Venational differences further distinguish *Atoposea* from the latter two Old World genera.

Unfortunately it has not been possible to describe the palpi of this monotypic genus due to the damaged condition of these structures in the single specimen available for study.

Atoposea maxima (Meyrick), new combination

FIGURES 15, 34, 63; MAP 4

Carposina maxima Meyrick, 1912a Trans. Ent. Soc. London, pt. 4, p. 673; 1922, Gen. Insect., fasc. 179, p. 7.—Clarke, 1963, Catalogue of the type specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick, vol. 4, p. 45, pl. 21, figs. 3–3b.

ADULT (fig. 15).—Wing expanse: ♂, 34–35 mm.

Head: Whitish except for pale brownish fringe of scales bordering eyes. Antennae pale brown; underside of scape whitish. (Labial palpi damaged.)

Thorax: Whitish to tawny with irregular, dark brown, transverse band across middle; whitish to pale brown underneath. Pro- and mesothoracic legs pale brown; metathoracic legs whitish, spurs slightly darker, brownish. Fore wings somewhat irregularly mottled with various shades of brown; darkest along costa, outer half of discal cell and between veins 3 and 6; whitish to tawny along lower half of wing and between vein 6 and 8; fringe pale brown to whitish. Hindwings uniformly grayish.

Abdomen: Whitish to pale brown above, paler beneath.

MALE GENITALIA (fig. 63).—Uncus conical, indistinctly set off from tegumen, setose; a dense tuft of elongate setae arising from area between uncus and tegumen. Tegumen relatively well developed, nearly as broad as valvae. Gnathos falciform (as viewed laterally), without setae or spines. Transtilla relatively weak, consisting of a narrow transverse band with a pair of setigerous, digitate processes arising at lateral junctions to valvae. Valvae elongate, constricted at apex of sacculus; ampulla clawlike, apical half divided into six, stout spines, decreasing in size ventrally toward base of valva; cucullus simple, without lobes or processes, broadly rounded at apex, densely clothed with fine setae throughout its length. Juxta indistinct, fused to basis of valvae. Subscaphium elongate; posterior end deeply forked one-fourth its total length. Vinculum a narrow ring, slightly enlarged at middle to form a small, triangular saccus. Aedeagus relatively complex

with apical half enlarged and divided; each half bearing a dense, elongate cluster of more than 50 short spinules.

TYPE.—Holotype, ♂; in the British Museum (Natural History).

TYPE-LOCALITY.—San Antonio, Colombia, 5800 feet.

HOST.—Unknown.

DISTRIBUTION (map 4).—Presently known only from the type-locality which is located in the Magdalena basin of Colombia.

MATERIAL EXAMINED.—One male.

SOUTH AMERICA: COLOMBIA: San Antonio, W. Colombia, 5800 feet, 1 ♂, Nov. (USNM).

Bondia Newman

Bondia Newman, 1856, Trans. Ent. Soc. London (new series), vol. 3 [1854–1856], p. 289.—Meyrick, 1910, Proc. Linn. Soc. New South Wales, vol. 35, pt. 1, p. 143.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180.—Meyrick, 1922, Gen. Insect., fasc. 179, pp. 2, 3.—Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 515; 1928, *in* Leonard, Cornell Univ. Agric. Exp. Sta. Mem. 101, p. 570.—Fletcher, 1929, Mem. Dept. Agric. India, Ent. series, vol. 11, p. 33.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61.—Diakonoff, 1954, Verhandl. Konink. Nederl. Akad. Wetensch., Afd. Natuur., vol. 49, no. 4, pp. 116, 119.

TYPE-SPECIES.—*Bondia nigella* Newman, 1856, monobasic.

ADULT.—Relatively small, slender bodied moths; wing expanse approximately 11–20 mm.

Head (figs. 44–53): Antennae sexually dimorphic; male with scales restricted mainly to dorsal and lateral surfaces of shaft; ventral surface densely covered with fine, elongate cilia; length of cilia approximately 2–3 × diameter of shaft; female antennae almost completely covered with scales; cilia minute, visible only under high magnification and approximately 0.5 × diameter of shaft. Labial palpi variable; sexually dimorphic in some species, not in others; relatively short and subascending in male, scales roughened and somewhat tufted beneath on second segment; female palpi either elongate and porrect with second segment mostly smooth beneath and roughened above, or short and subascending with scaling on second segment similar to that of male; length of second segment in female varying from 1 to 2 × the length of comparable segment in male.

Thorax: Wings (figs. 35–37) relatively slender in most species; termen strongly oblique. Primaries with all veins separate; vein 10 arising from cell approximately midway between 11 and 9; 11 arising near outer third of cell; 2 strongly curved, originating close to 3 near lower angle. Secondaries with discal cell extending half way to termen; veins 5 and 6 absent, the latter sometimes represented by a short vestige at termination of cell; 3 and 4 separate in most species, sometimes stalked about one-third the length of 3; rarely connate; cubital pecten present in some species, greatly reduced and restricted to

extreme wing base in others (including generotype); marginal fringe relatively elongate, equaling width of forewing in some species.

Male genitalia.—Uncus reduced typically to a small conical lobe, fused to tegumen. Tegumen relatively narrow. Gnathos absent. Transtilla usually well developed, often arched at middle. Valvae short, stout, outer half either entire or deeply divided into 2–4 lobes of various sizes. Aedeagus either elongate and slender or more shortened and clavate; cornuti usually numerous and arranged in dense patches, sometimes few in number and scattered; ejaculatory duct usually entering above middle. Spermatophore elongate, slender, approximately same diameter throughout; aperature either at middle or at apical end.

Female genitalia.—Ovipositor moderate to long; posterior apophysis usually about 1.5 × length of anterior pair. Sinus vaginalis broad; caudal portion of ductus bursae frequently expanded into a thick walled antrum; remainder of ductus bursae slender, gradually enlarging to form long, narrow corpus bursae; signa absent.

Discussion.—The systematic treatment of this genus, like that of *Carposina*, still leaves much to be desired. After an adequate study of all the specjes has been completed, it may be decided that the Australian species and the two more or less distinct groups of North American species require separate generic or subgeneric placements. As now envisaged, no single set of characters clearly defines the group, although a combination of several features loosely associates the known species. The male and female genitalia of the American forms are rather similar to those of the Australian in general morphology and provide the best set of characters for delimiting the group. Although the females of the generotype, *B. nigella*, possess similar genitalia, the morphology of the male genitalia diverges particularly in the structure of the valvae. In *B. nigella* the cucullus is simple and entire with a short but stout ampulla arising from the apex of the sacculus. In addition, this species differs from all the American forms, with the exception of *B. comonana*, in possessing strongly dimorphic labial palpi. The female palpi in the North American species gradually progress from the type observed in *B. fidelis*, in which the females are superficially identical to the males, through intermediate forms such as *B. crescentella*, to the extreme type possessed by *B. comonana*. The relative dimorphism of the labial palpi, beside being gradual, also does not appear to be correlated with any other characters as a possible criterion for subdividing the genus. For example, in the case of another interspecifically variable character studied, it was observed that some species with reduced palpi in the female had veins 3 and 4 stalked in the hindwings, whereas in others with similar palpi these veins were separate.

Part of the difficulty in understanding the American species of *Bondia* is due to the lack of associated material, particularly in those forms where only one sex is known. After this inadequacy has been remedied, it may be possible to re-evaluate the genus.

Key to the American Species of *Bondia*

1a. Hindwings with veins 3 and 4 stalked from cell (fig. 37), rarely connate.
  2a. Forewings unicolorous, black (fig. 21). . . . . **B. fuscata,** new species
  2b. Forewings lighter in color, grayish to fuscous, not unicolorous, with a whitish discal spot usually distinct as well as a dark transverse band at base of wing.
    3a. Female with lateral thickenings of lamella postvaginalis continuous with median lobe and not projecting posteriorally (fig. 104) . . . . . **B. fidelis**
    3b. Lateral thickenings of lamella postvaginalis largely separate from median lobe and projecting beyond it (fig. 107).
Bondia species no. 2

1b. Hindwings with veins 3 and 4 separate (fig. 36).
  2a. Forewings with a distinct, contrasting pattern of dark and whitish to grayish scales.
    3a. Outer third of forewing fuscous, distinctly set off from broad whitish to gray median band (fig. 16) . . . . . **B. comonana**
    3b. Outer third of forewing not darker than rest of wing (fig. 17); median band of white absent; a concentric ring of fuscous scales present near center of cell . . . . . **B. crescentella**
  2b. Forewings with relatively uniform maculation; markings when present usually indistinct, consisting of a number of small, scattered patches of dark scales.
    3a. Ground color of forewings grayish to medium fuscous.
      4a. Male with outer lobes of valvae relatively short and robust (fig. 70) . . . . . **B. spicata,** new species
      4b. Male with outer lobes of valvae elongate and slender (fig. 69). . . . . **B. shastana,** new species
    3b. Forewings dark fuscous, nearly black (fig. 25).
Bondia species no. 1

Bondia comonana (Kearfott)

FIGURES 1–2, 16, 36, 44–48, 64, 83, 101, 117; MAP 6

Carposina comonana Kearfott, 1907a, Trans. American Ent. Soc., vol. 33, no. 1, p. 87.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180 (no. 7557).—Meyrick, 1922, Gen. Insect., fasc. 179, p. 7 (synonym of *Carposina euryleuca* Meyrick).—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7628).—Klots, 1942, Bull. American Mus. Nat. Hist., vol. 79, art. 6, p. 416.—Essig, 1958, Insects and Mites of Western North America, p. 741.

Bondia comonana (Kearfott).—Keifer, 1943, Bull. Dept. Agric. California, vol. 32, no. 4, p. 258.

Carposina euryleuca Meyrick, 1912b, Ent. Monthly Mag., 2nd series, vol. 23 (vol. 48), no. 266 (no. 573), p. 35.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180 (no. 7557) (synonym of *Carposina comonana* Kearfott).—Meyrick, 1922, Gen. Insect., fasc. 179,

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p. 7.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 64 (no. 7628) (synonym of *Carposina comonana* Kearfott).

Adult (fig. 16).—Wing expanse: ♂, 14–19 mm.; ♀, 13–18 mm.

Head: Fuscous, heavily irrorated with white to tawny; base of each scale typically tawny, middle portion fuscous, apex white. Antennae with basal 2–3 segments fuscous, lightly irrorated with grayish white; each segment along basal half of shaft apically ringed with tawny, becoming entirely pale fuscous on outer half. Labial palpi fuscous, faintly irrorated with white; inner surfaces somewhat paler, particularly at base of second segment; apex of third segment grayish white; female palpi elongate, porrect, second segment approximately 1.5 X length of that of male; male palpi relatively short, subascending.

Thorax: Fuscous, irrorated with white; ventral surfaces whitish, irrorated with fuscous. Pro- and mesothoracic legs almost entirely fuscous; apices of tibial and tarsal segments ringed with grayish white; metathoracic legs pale fuscous, heavily irrorated with tawny to dull white, much paler on dorsal surface; tibial and tarsal segments with tawny to whitish apices. Forewings with a narrow, transverse band of fuscous at base and a much broader fuscous band covering outer third of wing; both bands slightly irrorated with whitish gray; area between dark bands mostly whitish with irregular concentrations of fuscous, particularly along costa and hind margin, tending to be most whitish at wing base near basal dark band; six or seven raised scale tufts usually present, scattered over broad, whitish median area; terminal fringe fuscous, irrorated with white. Hindwings pale fuscous, slightly darker toward apex; veins 3 and 4 separate.

Abdomen: Pale fuscous above, pale gray beneath.

Male genitalia (fig. 64).—Uncus reduced, partially membranous. Tegumen broadly rounded. Vinculum broad, extending as an elongate sheath along dorsum of aedeagus. Valvae very broad at base, outer half deeply divided into three distinct lobes of various form; dorsal lobe (cucullus) the longest in length and somewhat rounded at apex; median lobe the shortest, arising from base of cucullus, with apex somewhat mucronate; ventral lobe (sacculus) slender, subacute. Juxta triangular, about as broad as long. Vinculum Y-shaped, broad; saccus prominent; elongate. Aedeagus extremely slender, elongate, nearly doubling the genitalia in length; a series of two to five stout, elongate spines of varying lengths arranged internally along upper third of shaft to apex; junction of ejaculatory duct above middle near apical third.

Female genitalia (figs. 83, 101).—Ovipositor moderately elongate; posterior apophyses approximately 1.5 × length of anterior pair. Lamella antevaginalis quadrate, lightly sclerotized; posterior margin

truncate to slightly emarginate; a pair of rodlike structures laterad to lamella, each with a slightly enlarged, bilobed posterior end. Ductus bursae partly membranous, with a dark thickening near upper fourth; walls papillose throughout most of length, continuing over apical half of corpus; corpus bursae ovoid, lower half entirely membranous. Origin of ductus seminalis above middle of ductus bursae.

TYPE.—Lectotype, ♂, designated by Klots (1942); in the American Museum of Natural History.

TYPE-LOCALITY.—San Francisco, California.

HOST.—Fagaceae: "galls on oak [*Quercus* sp.]" (from specimen label). Rosaceae: "larvae bore in limbs of grafted French prune [*Prunus domestica* L.]" (Essig, 1958); "larvae bore in trunks and fruit of peach [*Prunus persica* (L.) Batsch]" (Keifer, 1943); "reared from peach crown gall; reared from black knot on western choke cherry [*Prunus demissa* (Nutt.) Dietr.]; reared from black knot on cherry [*Prunus* sp.]; reared from black knot on *Prunus virginiana* L.; reared from domestic prune [*Prunus domestica* L.]" (from specimen labels).

DISTRIBUTION (map 6).—In the United States this species is known to occur primarily west of the Rocky Mountains and throughout much of Maine. In Canada it ranges across the southern provinces from the Atlantic coast almost to the Pacific.

DISCUSSION.—Relatively little is known concerning the larval biology of this species other than it has been reared on numerous occasions from certain tumorous excrescenses often present on rosaceous trees of the genus *Prunus*. Presumably the larva is a borer in these tissues. Peach, prune, and cherry are mentioned most frequently as hosts, although a series of moths from Colorado were reportedly reared from oak galls. Most of the excrescenses occurring on *Prunus* are symptoms of a disease commonly referred to as black knot, which is caused by an ascomycetous fungus, *Plowrightia morbosa* (Schw.) Sacc. In the past this disease has been of considerable economic importance over certain areas of North America. Heald (1933) reports that black knot has been an important factor limiting the commercial production of plums and cherries, particularly east of the Alleghanies and from North Carolina to southern Ontario and Maine. Considering that the disease (and hosts) has been and perhaps still is more prevalent in the eastern part of the continent than the West, it seems rather unusual that present records indicate the moth to be more widely distributed in the West and practically absent from the eastern United States. Further information on the distribution and biological requirements of this species should clarify this apparent discrepancy.

In addition to black knot and oak galls, other hosts are reported. The moths have been reared in California from peach crown galls, a

Map 6.—Distribution of *Bondia comonana.*

disease produced by a bacterial pathogen, *Pseudomonas tumefaciens* (S. and T.) Duggar. Larvae of *B. comonana* are also known to attack healthy plant tissue. Essig (1958) reports large numbers of the larvae infesting the healthy limbs of French prune which had been grafted onto apricot trees. The insect became so abundant that several of the grafted limbs were killed. Keifer (1943) refers to the pest as the prune limb borer and states that the larva may occasionally enter peach fruit. The latter author also mentions that the species overwinters as a pupa inside a cocoon.

Carposina euryleuca was one of several names proposed by Meyrick (1912b) to replace a series of "barbarous" names used by Kearfott. Meyrick, being thoroughly schooled in Latin and Greek, objected to those names because of their nonclassical origin and submitted the specific epithet *euryleuca* as a replacement name for Kearfott's *comonana.* Under our current code of nomenclature, however, such a substitution is not valid and, thus, all of Meyrick's replacement names have since been synonymized.

MATERIAL EXAMINED.—56 males and 39 females.

CANADA: ALBERTA: Edmonton, 1 ♀, June 21 (CNC). MANITOBA: Minndosa, 1 ♀, emerged Feb. 23 (CNC). Oak River, 1 ♀, emerged Feb. 26 (CNC). Sandy Lake, 1 ♂, emerged Feb. 16 (CNC). Winnepeg, 1 ♂, emerged Feb. 23 (CNC). NOVA SCOTIA: Care Breton Highlands National Park, French Mountain, 1390 feet, 1 ♂, July 2 (NSM). QUEBEC: Forestville, 1 ♀, July 11 (CNC). Rawdon, 1 ♀, June 12 (CNC). SASKATCHEWAN: Greenwater Lake Provincial Forest, 1 ♂, emerged Feb. 16 (CNC). Isle à la Crosse, 1 ♂, emerged Jan. 24 (CNC). Moose Mountain Provincial Park, 3 ♂, Jan. 25–28 (CNC).

UNITED STATES: ARIZONA: Coconino Co.: Walnut Canyon, 6⅓ miles EESE of Flagstaff, 6500 feet, 1 ♀, Aug. 23 (JGF). Mohave Co.: specific locality unknown, 2 ♀, July 8–Aug. 15 (USNM). Santa Cruz Co.: Madera Canyon, Santa Rita Mountains, 4880 feet, 3 ♂, 1 ♀, May 31–Apr. 9, 1 ♂, 1 ♀, July 7–9, 2 ♀, Oct. 10–14 (JGF); 1 ♂, July 9, 1 ♀, Sept. 13 (USNM); 5600 feet, 1 ♂, Apr. 13, 1 ♀, Sept. 8 (JGF); 1 ♀, June 23, 1 ♀, Sept. 21 (USNM). CALIFORNIA: Specific locality unknown [probably San Francisco], 1 ♂, Apr. 22, cotype (USNM). Mariposa Co.: Yosemite, 2 ♂, 1 ♀, Aug. (USNM). Mendocino Co.: Mendocino, 1 ♂, Apr. 30 (UCB). Merced Co.: Livingston, 1 ♂, 3 ♀, emerged Apr. 13–20 (UCB). San Diego Co.: San Diego, 3 ♂, Feb. 16–Mar. 11 (UCB); 1 ♂, Feb. 2, 1 ♀, May 24–30, 1 ♂, 1 ♀, Oct. 6–8 (USNM). Santa Clara Co.: New Almaden, 1 ♀, July 21, 1 ♀, Oct. 3, 1 ♀, Dec. 1 (UCB); Santa Clara, 3 ♂, 2 ♀, Sept. 14–Oct. 2 (USNM). COLORADO: El Paso Co.: Colorado Springs, 1 ♀, June 10 (CU); N. Cheyenne Canyon, 2 ♂, 6 ♀, reared May "19/15" (USNM). MAINE: Aroostook Co.: De Boulie Mt. [south of St. Francis], 1 ♂, July 8 (AEB); Portage, 1 ♂, July 17 (AEB); Rocky Mt. [N.W. of St. Francis], 1 ♂, July 10 (AEB); St. Francis, 1 ♂, July 4 (AEB). Franklin Co.: Oquossoc, 3 ♂, July 6–12 (AEB). Lincoln Co.: Jefferson, 1 ♂, July 4 (AEB). Penobscot Co.: Lincoln, 14 ♂, 1 ♀, July 6–24 (AEB); 2 ♂, 1 ♀, July 5–14 (USNM). Washington Co.: Dennysville, 1 ♂, July 11 (AEB). York Co.: Specific locality unknown, 1 ♀, Aug. (AEB). UTAH: Tooele Co.: Loop Camp, 13 mi. S.W. Grantsville, 7400 feet, 1 ♂, July 1 (AMNH). WASHINGTON: Walla Walla Co.: Walla Walla, 5 ♂, 4 ♀, July 13 (USNM).

Bondia crescentella (Walsingham)

FIGURES 17, 65, 84, 102, 118; MAP 7

Carposina crescentella Walsingham, 1882, Trans. American Ent. Soc., vol. 10, p. 189. Riley, 1891, *in* Smith, List of the Lepidoptera of Boreal America, p. 103 (no. 5548). Dyar, 1902 [1903], U.S. Nat. Mus. Bull. 52, p. 489 (no. 5475).—Kearfott, 1903, *in* Smith, Check List of the Lepidoptera of Boreal America, p. 107 (no. 5896).—Busck, 1907, Journ. New York Ent. Soc., vol. 15, no. 1, p. 36.—Kearfott, 1907b, Canadian Ent., vol. 39, no. 4, p. 125.

Bondia crescentella (Walsingham).—Meyrick, 1913, Exotic Microlepidoptera, vol. 1, pt. 3, p. 71.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 180.—Meyrick, 1922, Gen. Insect., fasc. 179, p. 3.—Forbes, 1923, Cornell Univ. Agric. Exp. Sta. Mem. 68, p. 516, fig. 292; 1928, *in* Leonard, Cornell Univ. Agric. Exp. Sta. Mem. 101, p. 570.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7624).

ADULT (fig. 17).—Wing expanse: ♂, 12–19 mm.; ♀, 11–20 mm.

Head: Brownish to pale fuscous, irrorated with white; majority of scales with white tips. Antennae mostly pale fuscous; apex of each

segment ringed with white. Labial palpi of male and female relatively short, slightly dimorphic; length of second segment in male about three-fourths that of female; maculation similar between sexes, outer surfaces fuscous with slight irroration of white; inner surfaces paler with more white scales present; apex of third segment white.

Thorax: Anterior portion of dorsum fuscous with an irregular, transverse white band across middle, becoming darker again posteriorally. Ventral surfaces brownish to pale fuscous, strongly irrorated with white. Pro- and mesothoracic legs mostly fuscous, with apices of tibial and tarsal segments distinctly ringed with white; metathoracic legs with tibial and tarsal segments much paler; dorsal margin of tibia with long whitish hairs; tarsal rings obscure. Pattern of forewings variable, usually with an approximately equal mixture of whitish and grayish fuscous scales; an elongate, crescent-shaped patch of white at apex of discal cell; center of cell frequently with a circular ring of dark scales enclosing a smaller dark spot; base of wing with dark transverse band distinct; fresh specimens typically with three or four pale, yellowish spots distributed over wing which tend to become faded with age; one patch often present at base of wing along outer edge of transverse band, another at raised scale tuft situated near basal third of costa, and a third usually intermixed with whitish patch at cell apex. Hindwings uniformly gray; veins 3 and 4 separate.

Abdomen: Grayish to pale fuscous above and along sides, mostly whitish beneath.

Male genitalia (fig. 65).—Uncus relatively prominent, forming a broad lobe. Tegumen reduced to a narrow, ringlike band dorsally. Transtilla well developed, with a median, conical process projecting posteriorally. Apex of valvae broadly bilobed; cucullus ending in a small, apical tubercule; lobe of sacculus terminating in a more acute projection. Vinculum Y-shaped, tapering to form a moderately long and narrow saccus. Aedeagus relatively slender, of approximately uniform diameter throughout its length; apex with an obliquely curved, densely clustered row of stout spines, which increase in length toward base of aedeagus; inception of ejaculatory duct slightly above middle.

Female genitalia (figs. 84, 102).—Ovipositor relatively short; posterior apophyses only slightly longer than anterior pair. Lamella antevaginalis roughly quandrangular, with lateral margins parallel; anterior margin somewhat obliquely rounded; posterior margin bilobed, lobes moderate in length and of equal size. Upper (posterior) third of ductus bursae entirely membranous, antrum terminating in a broad, sigmoid curve; posterior two-thirds with a scattering of papillae. Corpus bursae relatively narrow and elongate. Origin of

Map 7.—Distribution of *Bondia crescentella*.

ductus seminalis at upper fourth of ductus bursae near juncture of antrum.

Type.—Lectotype, ♂ (present designation); "syntype; Maine, USA, 1882, C. H. Fernald; Walsingham Collection, 1910–427; *Carposina crescentella* Wlsm., Type ♀." In the British Museum (Natural History).

Type-locality.—Maine.

Host.—Unknown.

Distribution (map 7).—This species occurs most commonly from Nova Scotia in the southern half of the Appalachian Highlands to Minnesota and Arkansas along the eastern border of the Interior Plains. Although it is known to range across most of the southern border of Canada as far west as British Colombia, no records have been reported from the western half of the United States.

Discussion.—In his description of the species, Walsingham unfortunately provided no information as to the type-locality or exact

number of specimens in his original series. As stated in Walsingham's paper, *Bondia crescentella* was described from at least two specimens, a male and a female. One female syntype, herein designated as lectotype, from the Walsingham collection is now deposited in the British Museum. A locality label on this specimen gives its origin as "Maine, USA, 1882, C. H. Fernald." With the cooperation of Mr. Paul Whalley I was able to examine the specimen and, thus, to confirm the identity of the species. Two specimens, a male and female, from the Fernald collection and now residing in the collections of the U.S. National Museum probably represent a part of the original series which Fernald sent to Walsingham; however, because these specimens are both damaged to some extent (one represented merely by the right pair of wings) and bear no type labels, they were not considered in my designation of a lectotype.

Material examined.—61 males and 60 females.

CANADA: British Columbia: Adams River, 1 ♂, May 20 (CNC). Kaslo, 3 ♂, 1 ♀, Apr. 23–July 16 (CNC). Salmon Arm, 1 ♂, 1 ♀, Apr. 29 (CNC). Nova Scotia: Caledonia, 1 ♂, May 16 (NSM). Halifax, 1 ♀, May 22 (NSM); Boulderwood, 4 ♂, May 27–June 12 (NSM); Halifax Watershed Area, 1 ♂, June 4 (NSM); William's Lake, Purcell's Cove Road, 1 ♀, May 30 (NSM). Mount Uniacke, 2 ♀, May 29–June 26 (NSM). Ontario: Bell's Corners, 1 ♂, 1 ♀, Apr. 30 (CNC). Constance Bay, 1 ♂, Apr. 29 (CNC). Hymers, 1 ♀, June 1–7 (USNM). Merivale, 3 ♀, 2 ♂, Apr. 29–May 2 (CNC). Ottawa, 5 ♂, 2 ♀, Apr. 28–May 15 (CNC); 4 ♂, May 13–15 (USNM). Ottawa East, 1 ♂, Apr. 10 (CNC). Rockcliffe Park, 1 ♂, 1 ♀, May 1–19 (CNC). Quebec: Aylmer, 2 ♀, May 13–18 (CNC). Brome, 1 ♀, May 8 (CNC). Chelsea, 1 ♂, 1 ♀, Apr. 21–30 (CNC). Hull, 1 ♂, Apr. 22 (CNC). Montreal, 1 ♀, June 20 (CNC). Old Chelsea, 2 ♂, 2 ♀, Apr. 30–May 11 (CNC). Pinks Lake, 1 ♀, May 7 (CNC). Saskatchewan: Indian Head, 1 ♀, May 13 (CNC).

UNITED STATES: Arkansas: Washington Co.: Devil's Den State Park, 1 ♂, May 21 (USNM). Illinois: Putnam Co.: Specific locality unknown, 2 ♂, 1 ♀, Apr. 23–May 7 (MOG); 1 ♂, Apr. 29 (USNM). Maine: Specific locality unknown, 1 ♀, lectotype (BM); 1 ♂, 1 ♀ (USNM). Hancock Co.: Bar Harbor, 3 ♂, May 3–11 (CU). Massachusetts: Hampshire Co.: Amherst, 1 ♂, May 1 (USNM). Michigan: Ingham Co.: East Lansing, 1 ♂, 1 ♀, May 5 (USNM). Minnesota: Ramsey Co.: St. Anthony Park, 1 ♂, "⅙" (USNM). New Hampshire: Rockingham Co.: 2 ♂, May 25–30 (AEB). New York: Cattaraugus Co.: Rock City, 3 ♀, June 6–7 (CU). Herkimer Co.: Ilion, 1 ♀, Apr. 27 (USNM). Tompkins Co.: Danby, 1 ♀, May 9 (USNM). Ithaca, 1 ♂, Apr., 1 ♀, May 25 (CU); Six Mile Creek, 1 ♂, 7 ♀, Apr. 23–May 31 (JGF); 1 ♀, May 13 (NSM); 8 ♀, May 11–26 (USNM); McLean Bogs Reserve, 1 ♂, May 23 (CU); 1 ♂, 1 ♀, May (USNM). Ohio: Hamilton Co.: Cincinnati, 3 ♂, 2 ♀, Apr. 22–29 (AFB). Pennsylvania: Beaver Co.: New Brighton, 1 ♂, 1 ♀, May 14–21 (AMNH); 5 ♂, 6 ♀, May 6–30 (USNM). Lackawanna Co.: Scranton, 1 ♂, 2 ♀, May 14–19 (AMNH). West Virginia: Pendleton Co.: Spruce Knob Lake Campground, 3 ♂, 1 ♀, May 15–16 (USNM).

***Bondia shastana*, new species**

FIGURES 18, 69, 87, 103, 119; MAP 8

ADULT (fig. 18).—Wing expanse: ♂, 14–21 mm.; ♀, 14–20 mm.

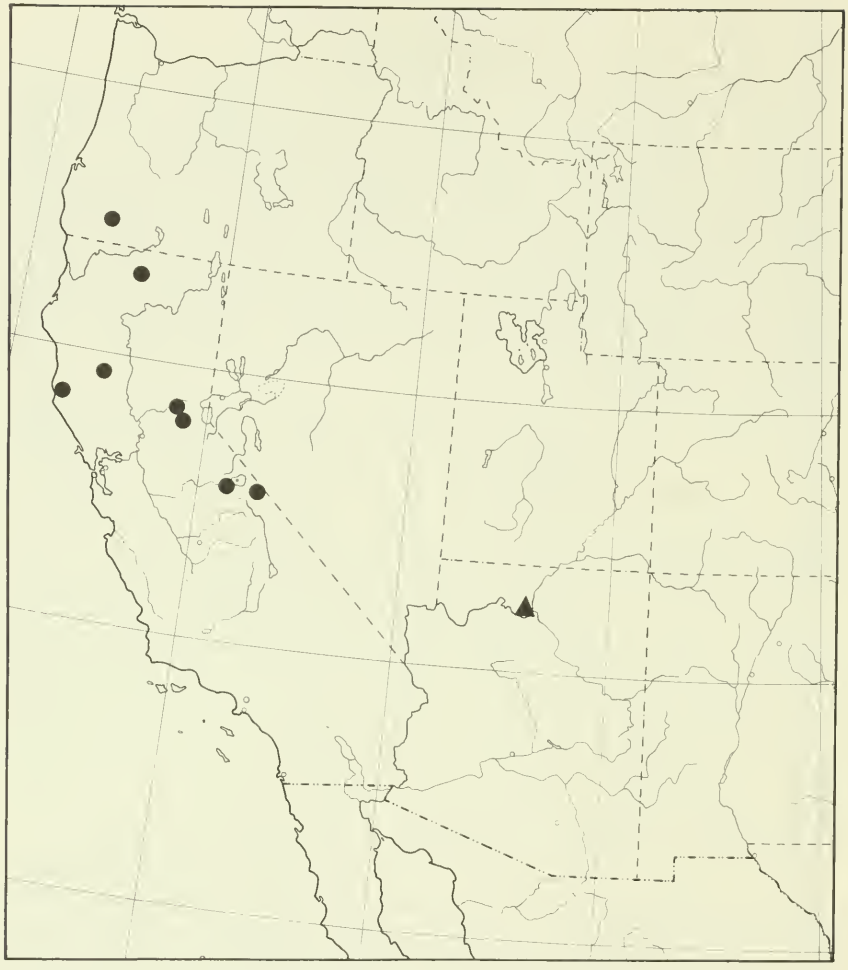
Head: Pale to medium fuscous with strong admixture of white; majority of scales with whitish apices. Antennae either mostly pale fuscous and indistinctly ringed with white or distinctly marked with white and fuscous bands of equal widths. Labial palpi pale brownish to dark fuscous becoming almost white on interior surfaces; apices of second and third segments with slight admixture of white; male and female palpi short and of approximately equal length, that of female slightly more porrect.

Thorax: Pale to dark fuscous, faintly irrorated with white; ventral surfaces paler, almost white in a few specimens. Pro- and mesothoracic legs largely fuscous; apices of tibial and tarsal segments ringed with white; metathoracic legs pale brown to whitish; apices of tarsal segments indistinctly ringed with white. Forewings medium gray to fuscous, heavily irrorated with white and faintly mottled with a dozen or more darker, transverse spots situated primarily at or near wing margin; transverse band faintly discernible at wing base; approximately five or six dark costal spots present; five or six raised scale patches usually evident around margin of discal cell; discal spot at apex of cell often whitish but rather indistinct in most specimens examined, including holotype; marginal fringe pale gray to fuscous, with a scattering of white-tipped scales. Hindwings uniformly pale gray; veins 3 and 4 usually separate, rarely connate.

Abdomen: Grayish to pale brownish fuscous above and below.

MALE GENITALIA (fig. 69).—Uncus indistinct, largely fused to tegumen. Tegumen reduced to a relatively narrow dorsal arch. Vinculum well developed, median area strongly projected as a stout conical lobe. Valvae broad at base; outer half deeply divided into two, curved, digitate processes. Juxta peltate, about as broad as long. Vinculum and saccus well developed, V-shaped. Aedeagus relatively slender and of about same diameter throughout length; apical third with a single, distinctly spaced row of 8–13 stout spines projecting laterally; juncture of ejaculatory duct near middle.

FEMALE GENITALIA (figs. 87, 103).—Ovipositor relatively long; posterior apophyses approximately 1.5 × length of anterior pair. Lamella antevaginalis deeply bilobed; posterior margin rounded; serrulate, extending caudad for a considerable distance beyond ostium. Antrum only moderately enlarged; walls slightly thickened. Ductus bursae mostly membranous, with a faint scattering of papillae at caudal end that gradually disappears toward elongate and slender corpus bursae. Inception of ductus seminalis midway along length of ductus bursae.



Map 8.—Distribution of Bondia species.

● *Bondia shastana* ▲ *Bondia spicata*

Holotype.—Mt. Shasta, California, 7,000 feet, ♂, July 16–23, ♂ genitalia slide DRD 1232, USNM 69654; in the United States National Museum.

Paratypes.—California: El Dorado Co.: Blodgett Forest, 13 mi. E. Georgetown, 17 ♂, 14 ♀, June 28 to July 20, 1967, coll. J. A. Powell (UCB); same data, 4 ♂, 2 ♀ (USNM). Glenn Co.: Plaskett Meadows, 6,200 feet, 1 ♀, July 3, 1960, coll. J. A. Powell, ♀ genitalia slide DRD 1810 (USNM). Mendocino Co.: Mouth of Albion River, 1 ♂, May 30–31, 1871, Walsingham 91860, ♂ genitalia slide DRD 1375 (BM). Mono Co.: Crooked Creek Lab, White Mts., 3 airline miles N.

of Inyo, 10,150 feet, 2 ♂, June 21–23, 1961, coll. J. A. Powell (UCB). Placer Co. Colfax, 1 ♂, May, coll. A. H. Vachell (AMNH). Tuolumne Co.: Ackerson Meadows, 3 miles S. of Mather, 4,700 feet, 1 ♂, June 11, 1960, coll. J. M. Burns (UCB). Oregon: Josephine Co.: Rogue River, 3 ♂, May 7, 1872, Walsingham 91854, ♂ genitalia slide DRD 1373, 91857, 91859 (BM): same data, 1 ♂, Walsingham 91855, ♂ genitalia slide DRD 1800 (USNM). Described from a total of 31 males and 17 females.

Host.—Unknown.

Distribution (map 8).—This species seems to be restricted primarily to the Sierra Nevada and Cascade Sections of the Pacific Mountains System from east-central California north to southern Oregon.

Discussion.—This species and the following one, *B. spicata*, are undoubtedly closely related and can be said to form a species group as evidenced particularly by the very similar male genitalia. The two species can be easily distinguished by the distinctly different forms of the valvae. The aedeagi of the two species are rather unique in possessing a single row of erect, spicate cornuti. It is possible that the higher number or relative position of the cornuti in *B. shastana* as compared to the few present in *B. spicata* is significant; however, it will be necessary to examine additional material in order to evaluate the relative variation and importance of this particular character.

The great amount of variation exhibited by *B. fidelis* may seem to question or minimize the genitalic differences mentioned above between *B. shastana* and *B. spicata*. In addition to those characters, however, there appears to be a basic difference in maculation between these two insects. Although the unique holotype of *B. spicata* is somewhat rubbed, its maculation appears nearest to *B. fidelis* and distinct from *B. shastana*. Furthermore, the female of the latter is known, and it is very possible that the unnamed *Bondia* discussed on page 65 as species no. 2 may represent the female of *B. spicata*.

Bondia spicata, new species

Figures 20, 70; Map 8

Adult (fig. 20).—Wing expanse: ♂, 16 mm.

Head: Fuscous, heavily irrorated with white; majority of scales with white apices. Antennae fuscous, faintly ringed with grayish white. Labial palpi pale fuscous; inner surfaces paler, grayish; most scales with whitish tips.

Thorax: Fuscous, irrorated with white; majority of scales white tipped; undersides of thorax almost uniformly grayish white. Pro- and mesothoracic legs pale fuscous, faintly irrorated with white; apices of tibial and tarsal segments faintly ringed with white; metathoracic

legs whitish, becoming more gray on tarsus; apices of tarsal segments whitish. Forewings fuscous, with faint scattering of whitish tipped scales; main concentration of white at outer margin of discal cell, forming a transverse, crescent-shaped spot; fringe fuscous, with scattering of white-tipped scales. Hindwings uniformly grayish; veins 3 and 4 separate.

Abdomen: Pale fuscous above, slightly paler below.

Male genitalia (fig. 70).—Uncus reduced, indistinct, consisting of a small conical lobe. Tegumen reduced, forming a narrow dorsal ring. Vinculum well developed, formed into a somewhat triangular hood projecting posteriorally between valvae. Valva broad at base; outer third divided into two irregularly curved lobes of unequal size; inner lobe approximately twice the width of lateral lobe; apices of both lobes curved inward slightly. Juxta broader than long, with a curved, digitate process arising dorsally. Vinculum and saccus V-shaped. Aedeagus about same diameter throughout length; apical third with 5 stout, distinctly spaced spines in a single row; juncture of ejaculatory duct at middle.

Holotype.—North Rim, Grand Canyon, Arizona, ♂, June 11, 1938, coll. Louis Schelbach, at lights, USNM 69655; in the United States National Museum.

Host.—Unknown.

Distribution (map 8).—At present, this species is known only from the type-locality, North Rim, Grand Canyon, Arizona, of the Colorado Plateau.

Discussion.—This species may be separated most easily from its nearest relative, *Bondia shastana*, through the use of genitalic features. As evidenced by the male genitalia, particularly in the structure of the aedeagus, these two species are closely allied and probably belong to the same species group. The lobes of the valvae in *B. spicata*, however, are more robust and of a shorter length (see figs. 69–70) than those of *B. shastana*. It is further possible that the different number of cornuti (i.e., 5 for *B. spicata* and 8–13 for *B. shastana*) reflects a reliable character, although this cannot be analyzed due to insufficient material.

At present the species is represented only by the male holotype, although it is possible that the unnamed *Bondia* described on page 65 will eventually be associated with this species. The prominent, spicate cornuti present in the aedeagus of this species has suggested the specific name, *spicata*.

Bondia fidelis Meyrick

Figures 19, 37, 49–53, 67–68, 85, 104, 121; Map 9

Bondia fidelis Meyrick, 1913, Exotic Microlepidoptera, vol. 1, pt. 3, p. 70.—Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal

America, p. 180 (no. 7553).—Meyrick, 1922, Gen. Insect., fasc. 179, p. 3.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7623).—Clarke, 1963, Catalogue of the type specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick, vol. 4, p. 41, pl. 19, figs. 3–36.

ADULT (fig. 19).—Wing expanse: ♂, 12–20 mm.; ♀, 12–17 mm.

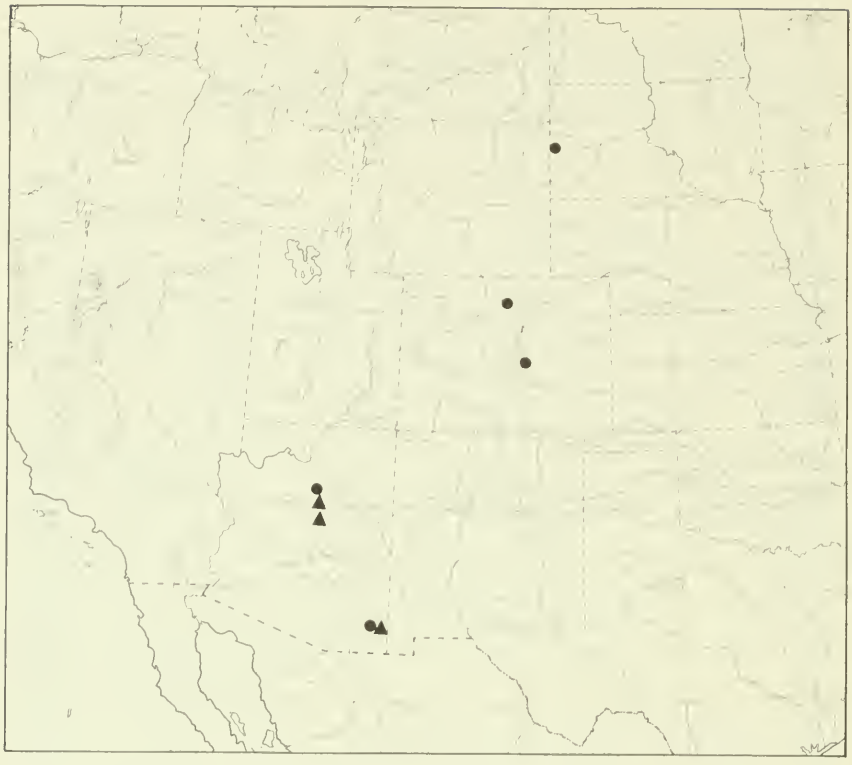
Head: Fuscous, irrorated with white; apices of most scales whitish. Antennae fuscous, faintly ringed with white; scales of scape with whitish apices. Labial palpi not sexually dimorphic, of approximately same size in male and female; second segment about 1.25 × length of third; subascending, fuscous, irrorated with white, usually with more white present on inner surface as compared to lateral surface; apex of terminal segment tipped with white.

Thorax: Fuscous, irrorated with white; anterior third or fourth darker, scales mostly fuscous; posterior two-thirds distinctly paler, scales mostly whitish; undersides of thorax considerably paler, whitish. Pro- and mesothoracic legs fuscous, irrorated with white; apices of tibial and tarsal segments faintly ringed with white; metathoracic legs paler, whitish; banding on tarsal segments only slightly discernible. Forewings of approximately same color as head; transverse band at wing base dark, outer margin sharply defined by paler scales; a white, often crescent-shaped patch of scales present at apex of cell; marginal fringe fuscous, with a scattering of white-tipped scales. Hindwings uniformly gray; veins 3 and 4 normally stalked approximately one-third their length; occasionally connate.

Abdomen: Grayish white above and below, with a lateral band of fuscous extending the entire length of the abdomen on either side.

MALE GENITALIA (figs. 67–68).—Uncus reduced to a small, setigerous rounded lobe. Tegumen reduced, forming a relatively narrow dorsal ring. Transtilla well developed, arched, often thickened at middle to form a rounded lobe projecting ventrally and caudad. Valvae variously lobed, usually with four distinct projections, three of which arise apically and one near middle; median apical lobe digitate, greatly exceeding other lobes in length. Juxta broad, peltate, firmly attached to base of valvae. Vinculum and saccus well developed, variable in form, Y- to V-shaped. Aedeagus clavate, apical end enlarged with an elongate, oblique patch of approximately 15–25 stout cornuti; inception of ejaculatory duct near middle.

FEMALE GENITALIA (figs. 85, 104).—Ovipositor relatively long; posterior apophyses approximately 1.5 × length of anterior pair. Lamella antevaginalis subtriangular, apex of triangle rounded and directed caudad; posterior margin mostly entire, slightly sinuate laterally; lamella postvaginalis consisting of a darkly sclerotized ring bordering posterior margin of lamella antevaginalis; ring thickened



MAP 9.—Distribution of *Bondia* species.

● *Bondia fidelis* ▲ *Bondia fuscata*

at sides and produced in middle to form a conical lobe. Ductus bursae completely membranous, narrow, gradually enlarging to form relatively slender, elongate corpus bursae. Origin of ductus seminalis approximately midway along length of ductus bursae.

TYPE.—Holotype, ♂; in the British Museum (Natural History).

TYPE-LOCALITY.—Colorado, 5,000 feet.

HOST.—Unknown.

DISTRIBUTION (map 9).—This species is known to occur from the eastern Basin and Range Province of southern Arizona north through the southern Rocky Mountains of Colorado to the Black Hills of western South Dakota.

DISCUSSION.—Previously this insect was thought to be rare, and for many years the only extant specimen known was the holotype deposited in the British Museum. Recent collecting, however, has

shown *Bondia fidelis* to be a relatively common, widespread species in the western United States.

More variation has been noted in the genitalic structure of this species than in any other New World carposinid. The genitalic structure of the female is rather uniform; however, considerable variation can be observed in the relative development of the vinculum-saccus in the male. Rather than attempt a detailed description of this variability, both extremes have been illustrated in figures 67 and 68. The observed variation was first suspected as being a possible indication of geographical subspeciation, especially since the Black Hills' population probably now exists completely isolated from the main southern extension of the species; however, subspecific names do not seem justified on the basis of these differences because both extreme types can be observed in either the Arizona or Black Hills material.

Of the species of *Bondia* now known, this species appears most related to *B. fuscata*. These two insects share in common two features that apparently are atypical for the genus, as exemplified by *B. nigella*. In contrast to the type-species of the genus and several other members, the labial palpi of *B. fidelis* and *B. fuscata* show no signs of sexual dimorphism, and veins 3 and 4 are stalked in the hindwings instead of being separate. An unnamed *Bondia* (species no. 2) discussed on page 65 may also share these eccentricities. The female genitalia of the latter species further resemble *B. fidelis* closely in the structure of the lamella postvaginalis. In each species the lateral elements of this structure are thickened, and there exists a lobelike median portion. In general, the lamella postvaginalis is more developed in all three of the species mentioned above than it is in most other species of *Bondia*, particularly *B. nigella*.

The letters and numbers T3N,R2E,S30 mentioned in the following section on distribution refer to a United States Geological Survey topographic map of the Four Corners Quadrangle, South Dakota.

Material examined.—87 males and 21 females.

UNITED STATES: Arizona: Cochise Co.: Chiricahua Mts. Bar Foot Ridge, 1 ♂, Aug. 5 (USNM); Rustler Park, 1 ♂, July 26 (CAS). Coconino Co.: Fort Valley, 7,350 feet, 7.5 mi. N.W. Flagstaff, 48 ♂, 8 ♀, June 19–28, 11 ♂, July 16–28 (USNM); 3 ♂, June 23–July 1 (JGF). Hart Prairie, 8,500 feet, 10 mi. NNW. Flagstaff, 3 ♀, June 23–25, 3 ♂, Aug. 2–11 (USNM); 3 ♂, July 2 (JGF). Hochderffer Hill, 8,500 feet, 12.5 mi. NNW. Flagstaff, 3 ♂, Aug. 12 (USNM). Colorado: Custer Co.: Specific locality unknown, 1 ♂ (USNM). El Paso Co.: Rock Creek Canyon, 1 ♂, July 14 (CPK); Rock Creek Canyon, Colorado Springs, 1 ♂, July 20 (CPK), 1 ♂, July 16 (USNM). Larimer Co.: Vicinity of Estes Park, 1 ♂, Aug. 4–5 (AMNH). South Dakota: Lawrence Co.: Hardy Work Camp, T3N,R2E,S30, 12 ♂, 10 ♀, July 4, 1 ♀ (USNM).

***Bondia fuscata*, new species**

FIGURES 21, 66, 86, 105, 122; MAP 9

ADULT (fig. 21).—Wing expanse: ♂, 11–16 mm.; ♀, 14–19 mm.

Head: Fuscous, irrorated with white; majority of scales white tipped. Antennae fuscous, indistinctly ringed with pale gray; scales of scape white tipped. Labial palpi not sexually dimorphic, of approximately same size in male and female; second segment about 1.25 × length of third; subascending, almost entirely fuscous, except for interior surfaces which are strongly irrorated with white; apex of terminal segment typically with a few white to grayish white-tipped scales.

Thorax: Fuscous to black, faintly irrorated with white to pale gray; ventral surfaces considerably paler, whitish. Pro- and mesothoracic legs fuscous with slight irroration of white; metathoracic leg paler in color; tibial hairs whitish; tarsal segments faintly ringed with pale gray. Forewings similar to dorsum of thorax in color, dark fuscous slightly irrorated with pale gray; pattern rather uniform over entire wing except for presence of faint, crescent-shaped patch of whitish scales occasionally present at apex of discal cell; fringe with mixture of fuscous and grayish white scales tipped with white. Hindwings uniformly gray; veins 3 and 4 stalked approximately one-third their length.

Abdomen: Uniformly pale gray above, more whitish below.

MALE GENITALIA (fig. 66).—Uncus reduced, consisting of a small conical lobe possessing either an entire or minutely clefted apex. Tegumen reduced to a relatively narrow dorsal arch. Transtilla relatively well developed, posterior margin evenly curved. Valvae broad at base, abruptly narrowing to form an acute, curved, apical lobe. Juxta broad, somewhat diamond-shaped. Vinculum and saccus well developed, V-shaped. Aedeagus claviform; apex with a dense, linear patch of 15–20 stout cornuti; juncture of ejaculatory duct near middle.

FEMALE GENITALIA (figs. 86, 105).—Ovipositor relatively long; posterior apophyses twice the length of anterior pair. Posterior margin of lamella antevaginalis slightly curved, almost truncate. Lamella postvaginalis with a prominent ridge extending medially and partially encircling a low, broadly conical lobe which arises medially just caudad of posterior margin of lamella antevaginalis. Ductus bursae entirely membranous, narrow beyond constriction of sinus vaginalis, gradually enlarging to form relatively narrow and elongate corpus bursae. Origin of ductus seminalis near caudal end of ductus bursae.

HOLOTYPE.—Vail Lake Road, 6,500 feet, 9.5 mi. S.E. Flagstaff, Coconino Co., Arizona, ♂, July 11, 1961, coll. R. W. Hodges, ♂ genitalia slide DRD 1614, USNM 69659; in the United States National Museum.

PARATYPES.—ARIZONA: Cochise Co.: Cave Creek Canyon, Chiricahua Mts., 5,400 feet, 6 ♂, 3 ♀, Aug. 4–23, 1966, coll. J. G. Franclemont (JGF). Silver Creek Wash, 7 mi. W. Portal, Chiricahua Mts., 4,880 feet, 1 ♂, 1 ♀, Aug. 4–11, 1966, coll. J. G. Franclemont (JGF). Southwestern Research Station, Chiricahua Mts., 5,400 feet, 1 ♂, Sept. 6, 1959, coll. J. R. Powers (UCB); 2 ♂, Sept. 4, 1959, coll. D. Linsdale (USNM); 1 ♂, July 31–Aug. 2, 1964, coll. D. R. Davis (USNM). Gila Co.: 4 mi. ESE. of Pine, 5,400 feet, 3 ♂, 1 ♀, Sept. 1–5, 1961, coll. R. W. Hodges (USNM). Described from a total of 15 males and 5 females.

HOST.—Unknown.

DISTRIBUTION (map 9).—This species is known only from the montane sections of central and southeastern Arizona at elevations exceeding 4,500 feet. Collections to date strongly suggest that its range in Arizona does not extend north of the Mogollon Rim.

DISCUSSION.—The relatively uniform, dark fuscous scaling of *Bondia fuscata* easily separates it from all other known forms of *Bondia*. In addition, this species along with *B. fidelis* exhibits certain features that appear atypical for the genus, thus making it more difficult to properly define the taxon. In both of these species, as well as in an unnamed species discussed on page 65, the labial palpi are not sexually dimorphic and veins 3 and 4 of the hindwings are stalked for a considerable distance. In addition to their very different maculation, *B. fuscata* may be further distinguished from *B. fidelis* by the dissimilar form of their valvae and lamellae postvaginales.

Tesuquea Klots

Tesuquea Klots, 1936, American Mus. Novitates, no. 867, p. 4.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61.—Diakonoff, 1954, Verhandel. Konink. Nederl. Akad. Wetensch., Afd. Natuur., vol. 49, no. 4, p. 118.

TYPE-SPECIES.—*Tesuquea hawleyana* Klots, 1936, original designation and monobasic.

ADULT.—Relatively small, slender bodied moths; wing expanse 11–16 mm.

Head (figs. 54–58): Antennae sexually dimorphic, scales restricted mostly to dorsal and lateral surfaces in both sexes; female with minute cilia visible only on ventral surface of apical third of shaft; ventral surface strongly ciliate in male, length of cilia approximately 1–2 × diameter of shaft. Labial palpi sexually dimorphic; relatively short and ascending in male, with second segment smooth above and somewhat roughened beneath; porrect and more elongate in female, with second segment relatively smooth beneath, strongly roughened toward apex above; and approximately 1.5 × that of male in length; apical segment short, obtuse.

313-145 O—68——5

Thorax: Wings (fig. 38) relatively slender; termen strongly oblique. Primaries with all veins separate; vein 10 arising from cell considerably closer to 9 than to 11; 11 originating somewhat basad at about middle of cell; 2 almost straight to margin, arising from outer three-fourths of cell, well separated from 3. Secondaries with discal cell extending half way to termen; veins 5 and 6 absent, the latter represented by a short vestige at termination of cell; 3 and 4 stalked about one-fourth their length; cubital pecten present. Marginal fringe of both wings relatively long.

Male genitalia.—Uncus well developed, simple. Gnathos fused, V-shaped. Tegumen simple. Vinculum weak, reduced to a narrow ring ventrally; saccus undeveloped. Transtilla absent. Valvae relatively slender, except for basal expansion of sacculus. Aedeagus reduced in length, somewhat membranous; ejaculatory duct entering below middle near base. Spermatophore very slender, elongate; aperture at enlarged apical end.

Female genitalia.—Ovipositor relatively short, broad; posterior apophysis somewhat shortened, less than 1.5 × length of anterior pair. Sinus vaginalis strongly dilated; ductus bursae slender, elongate; corpus bursae slightly enlarged; signa absent.

Tesuquea hawleyana Klots

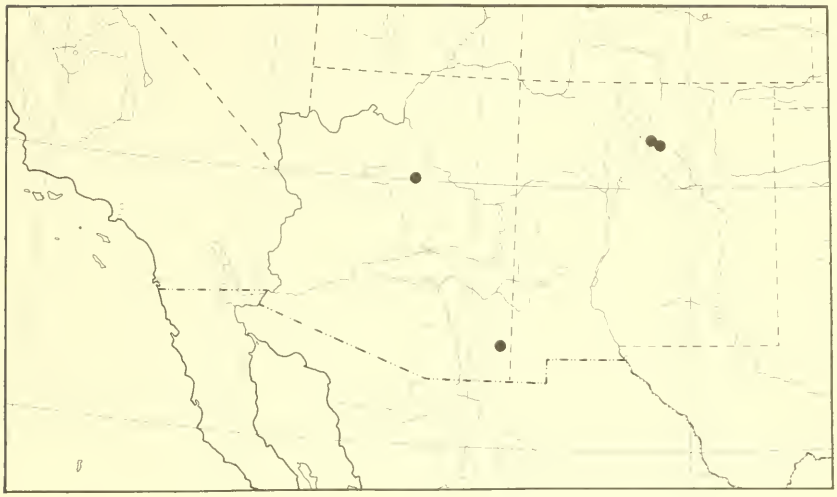
Figures 22, 38, 54–58, 71, 90, 108, 116; Map 10

Tesuquea hawleyana Klots, 1936, American Mus. Novitates, no. 867, p. 4, figs. 6–8.—McDunnough, 1939, Mem. S. California Acad. Sci., vol. 2, no. 1, p. 61 (no. 7629).—Klots, 1942, Bull. American Mus. Nat. Hist., vol. 79, art. 6, p. 416.

Adult (fig. 22).—Wing expanse: ♂, 11–14 mm.; ♀, 16 mm.

Head: Front grayish fuscous; vertex paler, grayish white. Antennae pale gray above and beneath except for fuscous band encircling basal third of each segment; dorsum of scape fuscous. Palpi fuscous, mottled with grayish white.

Thorax: Largely fuscous above with slight suffusion of gray; ventral surfaces primarily pale gray. Legs primarily fuscous above and pale gray beneath except for whitish tips of tibial and tarsal segments. Primaries largely pale gray irrorated with fuscous, usually with five distinct fuscous markings of various sizes distributed as follows: a large, transversely oblique band across wing base; a large trapezoidal patch about midway along costa; a short, sometimes interrupted, transverse band at end of discal cell; a similar, strongly tufted band or spot partly across lower third of wing; and a small discal spot midway between two short, transverse bands; outer fourth of wing sometimes with suffusion of dark scales. Secondaries gray; fringes of both wings gray.



Map 10.—Distribution of *Tesuquea hawleyana*.

Abdomen: Dorsal and ventral surfaces gray.

Male genitalia (fig. 71).—Uncus elongate and stout, tapering to an acute apex. Tegumen relatively broad at apex, narrowing ventrally toward junction of vinculum. Lateral arms of gnathos slender, becoming broader at median juncture. Valvae with expanded sacculus bearing a single, large, curved spine; cucullus elongate, slender, with apex rounded. Apex of aedeagus entire, slightly broader than basal half, with two, V-shaped bands of minute spines diverging from middle toward apex. Spermatophore (fig. 116) consisting of two distinct regions: an elongate, somewhat coiled posterior part with heavily thickened walls, and an enlarged, membranous anterior region from which the sperm escape.

Female genitalia (figs. 90, 108).—Lamella antevaginalis broadly rectangular; posterior margin simple, truncate. Antrum and corpus bursae entirely membranous. Ductus bursae elongate, slender, lower half covered with numerous, minute papillae; upper half membranous. Juncture of ductus seminalis midway along ductus bursae.

Type.—Holotype, ♂; in the American Museum of Natural History.

Type-locality.—Hyde State Park, Little Tesuque Canyon, Sangre de Cristo Range, near Sante Fe, New Mexico. Altitude approximately 9,200 feet.

Host.—Unknown.

Distribution (map 10).—Presently known only from montane Arizona and New Mexico at elevations above 6,000 feet.

Discussion.—The pronounced separation of veins 2 and 3 in the forewing provides a reliable, diagnostic character for this genus and

species. In all other known members of this family, both of these veins are strongly curved at their bases and originate closely approximate one another from the lower angle of the discal cell.

Klots (1936), in his description of this species, comments that the original series of two specimens was taken at light in a meadow surrounded by typical, Canadian Zone, coniferous and quaking aspen forest.

Material examined.— Six males and two females.

UNITED STATES: Arizona: Cochise Co.: Turkey Flat, Chiricahua Mts., 8,000 feet, 1 ♀, July 22 (CAS); Bar Foote Ridge, Chiricahua Mts., 8,500–9,700 feet, 1 ♂, Aug. 5 (UCB). Coconino Co.: Vail Lake Road, 9.5 miles SE. Flagstaff, 6,500 feet, 1 ♂, July 18 (USNM). Walnut Canyon, 6½ miles EESE. Flagstaff, 6,500 feet, 1 ♂, 1 ♀, Aug. 25 (JGF). New Mexico: Santa Fe Co.: Hyde State Park, Little Tesuque Canyon, Sangre de Cristo Mts., 9,200 feet, 1 ♂, paratype, July 27–Aug. 10 (ABK). San Miguel Co.: Sangre de Cristo Mts., near Cowles, 1 ♂, July 23 (AFB); 1 ♂, July 23 (USNM).

Unnamed Species

Four species, represented for the most part by inadequate material, have not been named at this time but are discussed on the following pages largely for the purpose of attracting the attention of future workers and collectors to these oddities. The majority probably represent undescribed species which, however, should not be formally christened until sufficient material becomes available for study.

Carposina species, no. 1

Figures 23, 82, 100, 113; Map 5

Adult (fig. 23).—Wing expanse: ♀, 17 mm.

Head: Pale tawny, almost white. Antennae whitish at base becoming pale fuscous toward apex. Labial palpi with second segment brownish fuscous along ventral half, becoming tawny and then whitish dorsally; apical half of third segment whitish.

Thorax: Collar and tegulae whitish; dorsum tawny, becoming darker posteriorally; venter whitish to tawny. Pro- and mesothoracic legs brownish fuscous, irrorated with white; apices of tarsal segments faintly ringed with white; metathoracic legs mostly whitish, becoming slightly darker on tibial and tarsal segments. Forewings light brown, obscurely marked with darker shades of brownish fuscous; costal margin mostly dark, interrupted beyond middle by six or seven narrow, whitish spots; most of termen (below R_5) and discal area brownish fuscous; raised scale patch at apex of cell fuscous. Hindwings uniformly gray. Venation of both wings as in subgenus *Carposina*.

Abdomen: Pale brown above and below.

Female genitalia (figs. 82, 100).—Lamella antevaginalis relatively narrow at ostium, becoming broader anteriorally; posterior margin simple, slightly curved inwards. Posterior third of ductus bursae with papillae reduced, walls membranous except at sides near juncture with lamella antevaginalis; anterior two-thirds of ductus partly papillose, with papillae arranged in two broad bands extending to corpus. Corpus bursae expanded and ovoid, with a pair of slender furcate signa.

Host.—Unknown.

Distribution (map 5).—Presently reported only from Costa Rica.

Discussion.—This unnamed species agrees in venation with *C. phycitana* as described by Walsingham and may actually represent the female of that species; however, largely due to the poor condition of *C. phycitana*, a more precise comparison cannot be made, and any further discussion will have to await the collecting of additional material.

Material examined.—One female: Costa rica: Orosi, 1500 m. [?], 1 ♀, (VNM).

***Carposina* species, no. 2**

Figures 24, 32; Map 5

Adult (fig. 24).—Wing expanse: ♀, 19 mm.

Head: Whitish with a pale suffusion of tawny along front (antennae and labial palpi damaged).

Thorax: Collar and tegulae whitish; dorsum stramineous; venter whitish. Legs whitish to tawny; tarsal segments indistinctly tipped with white. Forewings stramineous, faintly marked with a few scattered patches of brownish scales present mainly along costal margin, termen, and at apex of discal cell. Veins 10 and 11 connate (fig. 32); 8 and 9 stalked one-third their length; all other veins arising separate from cell. Hindwings pale gray; veins 3 and 4 slightly separate.

Abdomen: Missing.

Host.—Unknown.

Distribution (map 5).—Known only from Volcan Sta. Maria, Guatemala, which is situated in the Central American Volcanic Upland.

Discussion.—This species, represented by only one imperfect specimen, is mentioned largely because of its superficial resemblance to *C. phycitana* and its rather peculiar venation, which immediately distinguishes it from Walsingham's insect. The forking of veins 8 and 9 in the primaries is similar to the condition present in the subgenus *Epipremna*, whereas the origins of 10 and 11 are most similar to that found in the subgenus *Trepsitypa*. Because the origin of these particular veins is believed to be relatively constant in this group

of moths, the insect described above is probably new. Because of its damaged condition, however, the species should not be named until better specimens are available for study.

Material examined.—1 female: Guatemala: Volcan Sta. Maria, 1 ♀, Schaus and Barnes coll. (USNM).

Bondia species, no. 1

Figures 25, 88, 106, Map 11

Adult (fig. 25).—Wing expanse: ♀, 15–17 mm.

Head: Fuscous, majority of scales with pale grayish aspices. Antennae fuscous, banded with gray. Labial palpi of female relatively short; second segment approximately 1.25 × length of third; subascending, fuscous; majority of scales with extreme apices slightly paler, gray; inner surfaces of palpi mostly gray.

Thorax: Fuscous, tips of most scales grayish; venter of thorax grayish to pale fuscous. Legs grayish, irrorated with fuscous; metathoracic legs palest in color; apices of tibial and tarsal segments faintly ringed with grayish white. Forewings fuscous, faintly irrorated with pale gray to white; transverse band at wing base obscure but present; outer margin of discal cell marked by a whitish, crescent-shaped patch of scales; fringe fuscous, with a scattering of white-tipped scales. Hindwings uniformly grayish to pale fuscous; veins 3 and 4 separate.

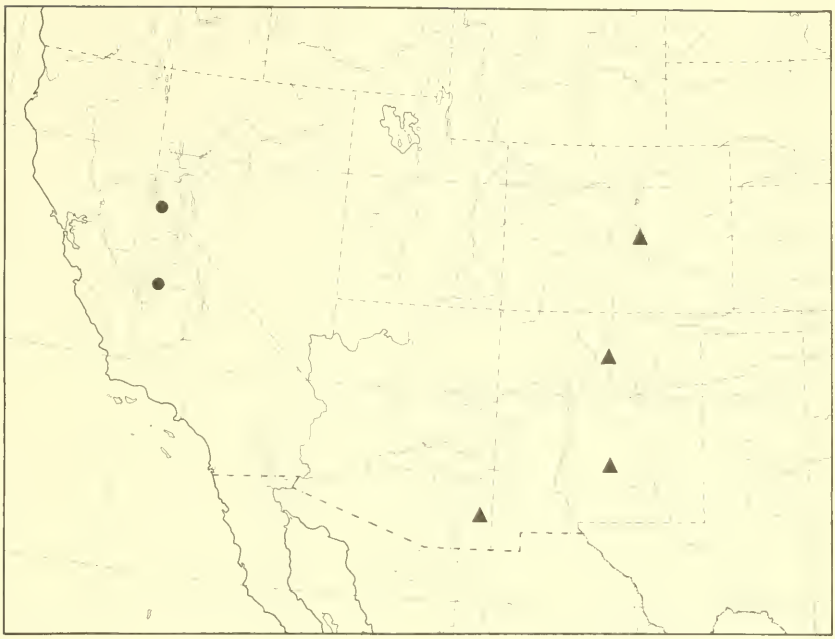
Abdomen: Grayish to fuscous; slightly paler underneath than above.

Female genitalia (figs. 88, 106).—Ovipositor moderately long; posterior apophyses approximately 1.5 × the length of anterior pair. Lamella antevaginalis prominent, well sclerotized, somewhat funnel-shaped; posterior margin irregularly rounded. Lamella postvaginalis roughly quadrate; posterior margin moderately to relatively deeply incised at middle, sometimes nearly truncate. Walls of antrum thickened, finely reticulate, becoming more papillose toward constricted part of ductus bursae. Ductus bursae largely membranous with scattered papillae, gradually enlarging to form a relatively small and membranous corpus bursae. Origin of ductus seminalis from membranous section of ductus bursae anterior of termination of antrum.

Host.—Pinaceae: "From Jeffrey Pine [*Pinus ponderosa* var. *jeffreyi* Vasey]" (from specimen label).

Distribution (map 11).—Presently known only from the Sierra Nevada Section of east-central California.

Discussion.—Most probably this species is new but because no male specimens have as yet been discovered no name has been proposed. The labial palpi of this species is very similar to the females of *B. fidelis* and *B. fuscata* in being relatively short and subascending;



MAP 11.—Distribution of *Bondia* species.

● *Bondia* species, no. 1 ▲ *Bondia* species, no. 2

however, this species differs from that group in having veins 3 and 4 separate in the hindwings.

The host association was obtained from information on specimen labels. Unfortunately, no information is presently available as to what area of the plant is attacked.

MATERIAL EXAMINED.—Four females.

UNITED STATES: CALIFORNIA: Alpine Co.: Carson River, 8 mi. S. Markleeville, 1 ♀, June 22, 1962, coll. J. A. Powell (UCB). Fresno Co.: Pinehurst, 2 ♀, coll. Dec. 7, 1965, em. Feb. 23–24, 1966, coll. H. B. Teillon, ex. Jeffrey Pine (CDA, USNM). Mono Co.: 4 mi. E. Monitor Pass, 1 ♀, June 24, 1962, coll. J. A. Powell (UCB).

***Bondia* species, no. 2**

FIGURES 26, 89, 107, 120; MAP 11

ADULT (fig. 26).—Wing expanse: ♀, 16 mm.

Head: Fuscous, heavily irrorated with white; majority of scales with white apices. Antennae grayish to pale fuscous, ringed with grayish white. Labial palpi of female relatively short; second segment approximately 1.25 × length of third; subascending, fuscous; majority of scales with whitish apical margins; scales of inner surfaces with more white.

Thorax: Fuscous, irrorated with white; majority of scales whitish tipped; most of ventral surface grayish white, with a slight scattering of darker gray scales. Pro- and mesothoracic legs pale fuscous, irrorated with white; apices of tibial and tarsal segments faintly ringed with white; metathoracic leg slightly paler. Forewings fuscous, with irregular scattering of whitish or whitish tipped scales concentrated somewhat along basal third of costa and at outer margin of discal cell, forming a conspicuous, white, crescent-shaped mark; transverse fuscous band at wing base distinct; fringe fuscous with irregular scattering of white-tipped scales. Hindwings pale gray to whitish, slightly darker at apex and anal area of wing; veins 3 and 4 stalked over one-third their length.

Abdomen: Pale fuscous above, slightly paler beneath.

Female genitalia (figs. 89, 107).—Ovipositor relatively long; posterior apophyses slightly less than twice the length of anterior pair. Lamella antevaginalis broad, lateral margins strongly curved outwards; posterior margin entire and strongly curved posteriorly; ostium bounded laterally by a pair of darkly sclerotized, elongate sclerites. Lamella postvaginalis with a darkly sclerotized, somewhat rounded, median lobe. Antrum enlarged, globose; walls thickened but smooth, not reticulate or papillose; abruptly narrowing to form slender, largely membranous ductus brusae; walls of latter with a relative sparse scattering of papillae. Corpus bursae elongate, slender. Inception of ductus seminalis at caudal end of ductus bursae near termination of antrum.

Host.—Unknown.

Distribution (map 11).—Presently known only from the southern Rocky Mountains and Basin and Range Province from central Colorado south to southern New Mexico and Arizona.

Discussion.—This species resembles *Bondia spicata* very closely in maculation as well as size and may represent the opposite sex of that species, which is known only from the unique male. There exists, however, one discordant feature which may prove of great significance in separating these two entities. In *B. spicata*, veins 3 and 4 of the hindwing are separate, whereas in the unnamed species described above these two veins are stalked for a considerable distance. Such a degree of intraspecific variation in venation has not been observed in this family; instead, venational characters have been found rather constant in those species studied which were represented by adequate samples. Both palpal and venational characters suggest that this unnamed species is closely allied to *B. fidelis*, and it possibly may be referred to that species group as soon as the male is discovered. Thus, I have not arbitrarily associated these two sexes under a single name but deem it preferable to await additional infor-

mation which hopefully will be supplied through further collecting and rearing.

MATERIAL EXAMINED.—Five females.

UNITED STATES: ARIZONA: "So. Arizona," specific locality unknown, 1 ♀, coll. Poling (AMNH). Cochise Co.: Chiricahua mts., Bar Foot Ridge, 1 ♀, Aug. 5 (CAS). COLORADO: El Paso Co.: Rock Creek, vicinity of Colorado Springs, 1 ♀, Aug. 25, 1935, coll. A. B. Klots (USNM). NEW MEXICO: Lincoln Co.: Cedar Creek Camp, 2 mi. N. Ruidoso, 7,000 ft., 1 ♀, July 1, 1961 (AMNH). Santa Fe Co.: Little Tesuque Canyon, vicinity of Santa Fe, 9,200 feet, 1 ♀, July 27–Aug. 10, 1932 (USNM).

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Figures 1–122

FIGURE 1.—Limb of western choke cherry, *Prunus demissa* from Yosemite, California, infected with black knot disease; gall in turn was infested with larvae of *Bondia comonana* (Kearfott). Total length of gall 5.75 inches.

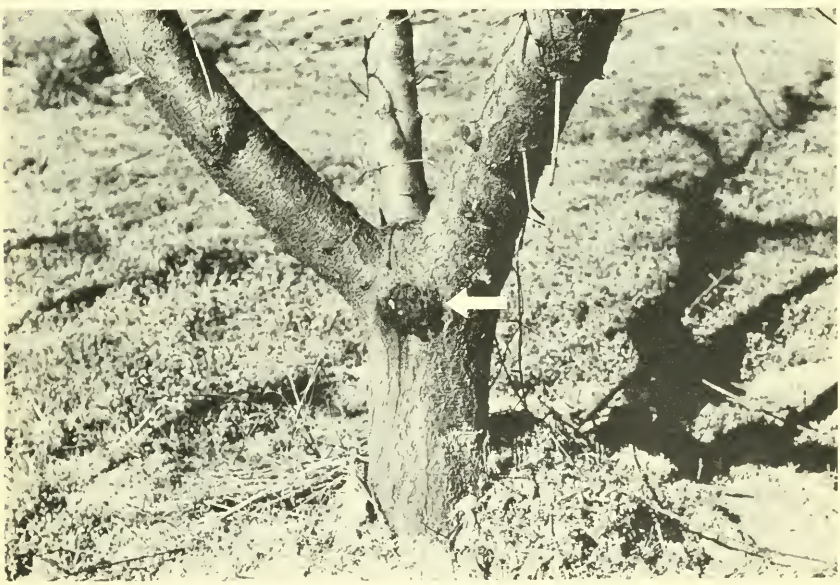

FIGURE 2.—Gall of black knot disease (see arrow) on trunk of *Prunus* species from California. (Photograph courtesy of George Okumura.)

FIGURES 3–10.—Adults

3. *Carposina* (*Carposina*) *niponensis ottawana*, female, Putnam Co., Illinois, wing expanse 14 mm.
4. *Carposina* (*Carposina*) *niponensis ottawana* (lectotype, *C. nicholsana*), male, Nicholson, Pennsylvania, wing expanse 14 mm.
5. *Carposina* (*Carposina*) *fernaldana*, female, Six Mile Creek, Ithaca, New York, wing expanse 18 mm.
6. *Carposina* (*Carposina*) *simulator*, holotype, female, Devil's Den State Park, Washington Co., Arkansas, wing expanse 15 mm.
7. *Carposina* (*Carposina*) *biloba*, holotype, female, Pensacola, Florida, wing expanse 17 mm.
8. *Carposina* (*Carposina*) *engalactis*, lectotype, female, Neu-Bremen, Santa Catarina, Brazil, wing expanse 18 mm.
9. *Carposina* (*Carposina*) *phycitana*, holotype, male, Volcan de Chiriqui, Panama, wing expanse 17 mm. (Photograph courtesy of British Museum (Natural History)).
10. *Carposina* (*Trepsitypa*) *cardinata*, lectotype, female, Bartica, Guyana, wing expanse 14 mm. (Photograph courtesy of British Museum (Natural History)).

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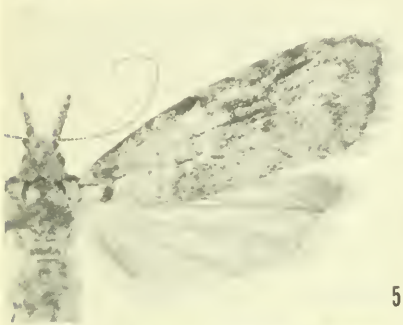
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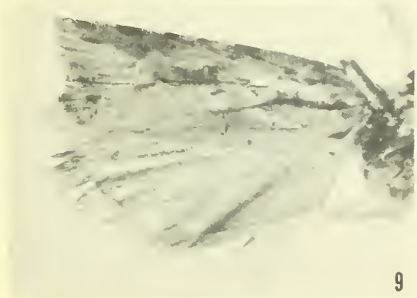
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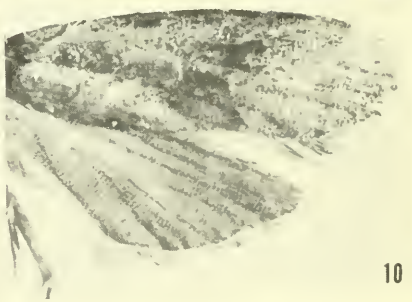
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FIGURES 11–18.—Adults

11. *Carposina* (*Epipremna*) *dominicae*, paratype, female, 2 miles NW. of Pont Cassé, Dominica, wing expanse 15 mm.
12. *Carposina* (*Epipremna*) *dominicae*, holotype, male, 2 miles NW. of Pont Cassé, Dominica, wing expanse 15 mm.
13. *Carposina* (*Dipremna*) *cretata*, holotype, male, El Yunque Biological Station, Luquillo Forest, Puerto Rico, wing expanse 15 mm.
14. *Carposina* (*Hypopremna*) *bullata*, female, 2 miles NW. Pont Cassé, Dominica, wing expanse 13 mm.
15. *Atoposea maxima*, male, San Antonio, Colombia, wing expanse 34 mm.
16. *Bondia comonana*, female, Livingston, California, wing expanse 15 mm.
17. *Bondia crescentella*, female, Six Mile Creek, Ithaca, New York, wing expanse 16 mm.
18. *Bondia shastana*, holotype, male, Mt. Shasta, California, wing expanse 14 mm.

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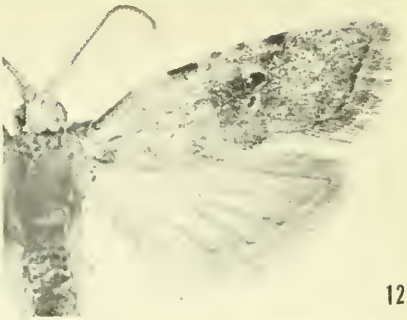
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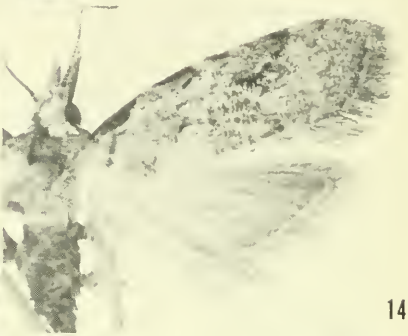
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FIGURES 19–26.—Adults

19. *Bondia fidelis*, female, Hardy Work Camp, Lawrence Co., South Dakota, wing expanse 16 mm.
20. *Bondia spicata*, holotype, male, North Rim Grand Canyon, Arizona, wing expanse 16 mm.
21. *Bondia fuscata*, paratype, male, Cave Creek Canyon, Chiricahua Mts., Arizona, wing expanse 15 mm.
22. *Tesuquea hawleyana*, male, Walnut Canyon, 6⅓ miles EESE. Flagstaff, Arizona, wing expanse 13 mm.
23. *Carposina* species, no. 1, female, Orosi, Costa Rica, wing expanse 17 mm.
24. *Carposina* species, no. 2, female, Volcan Sta. Maria, Guatemala, wing expanse 19 mm.
25. *Bondia* species, no. 1, female, Pinehurst, California, wing expanse 16 mm.
26. *Bondia* species, no. 2, female, Rock Creek, vic. Colorado Springs, Colorado, wing expanse 16 mm.

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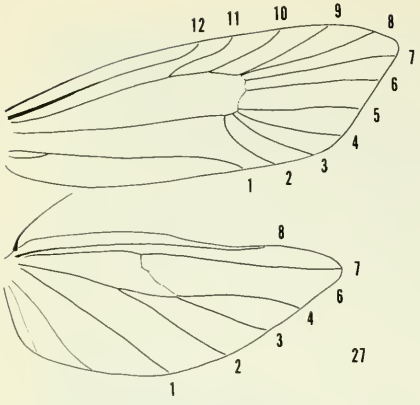
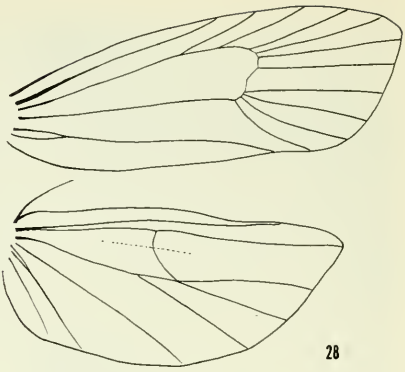
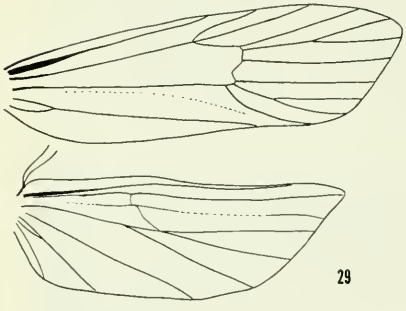
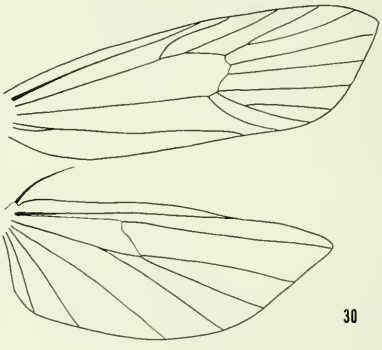
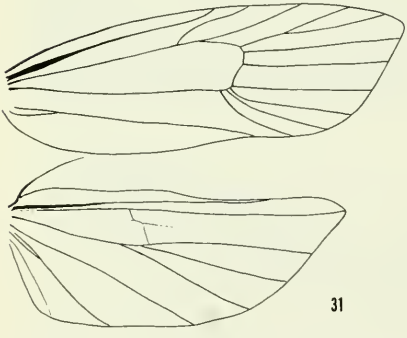
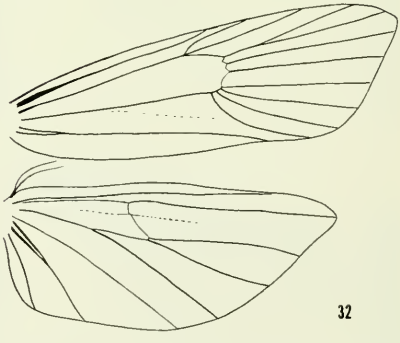




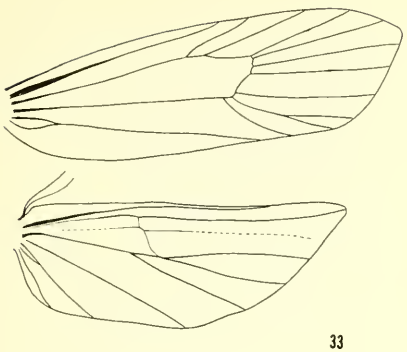


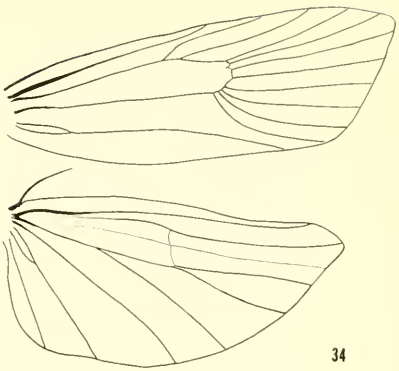


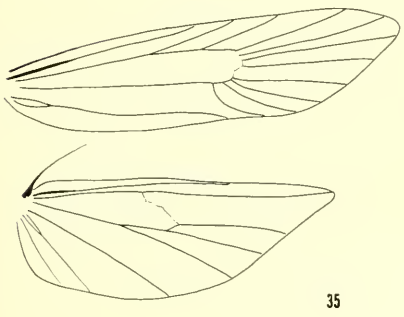


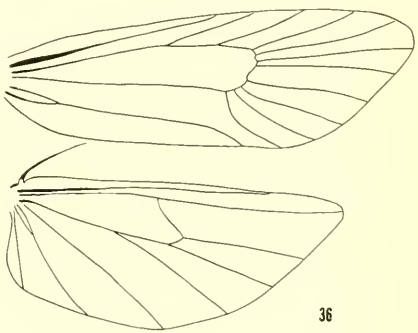


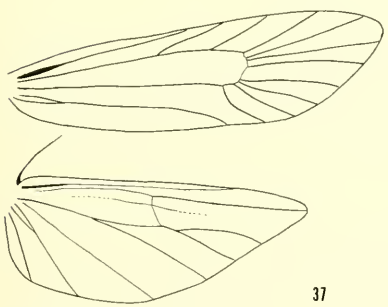
FIGURES 27–32.—Wing venation: 27, *Carposina* (*Carposina*) *berberidella;* 28, *Carposina* (*Carposina*) *fernaldana;* 29, *Carposina* (*Trepsilypa*) *cardinata;* 30, *Carposina* (*Dipremna*) *cretata;* 31, *Carposina* (*Epipremna*) *dominicae;* 32, *Carposina* species, no. 2.

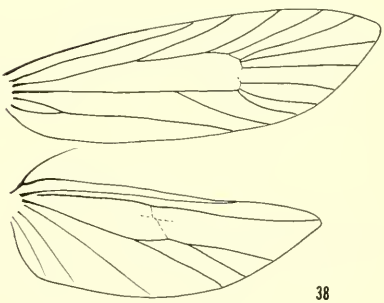




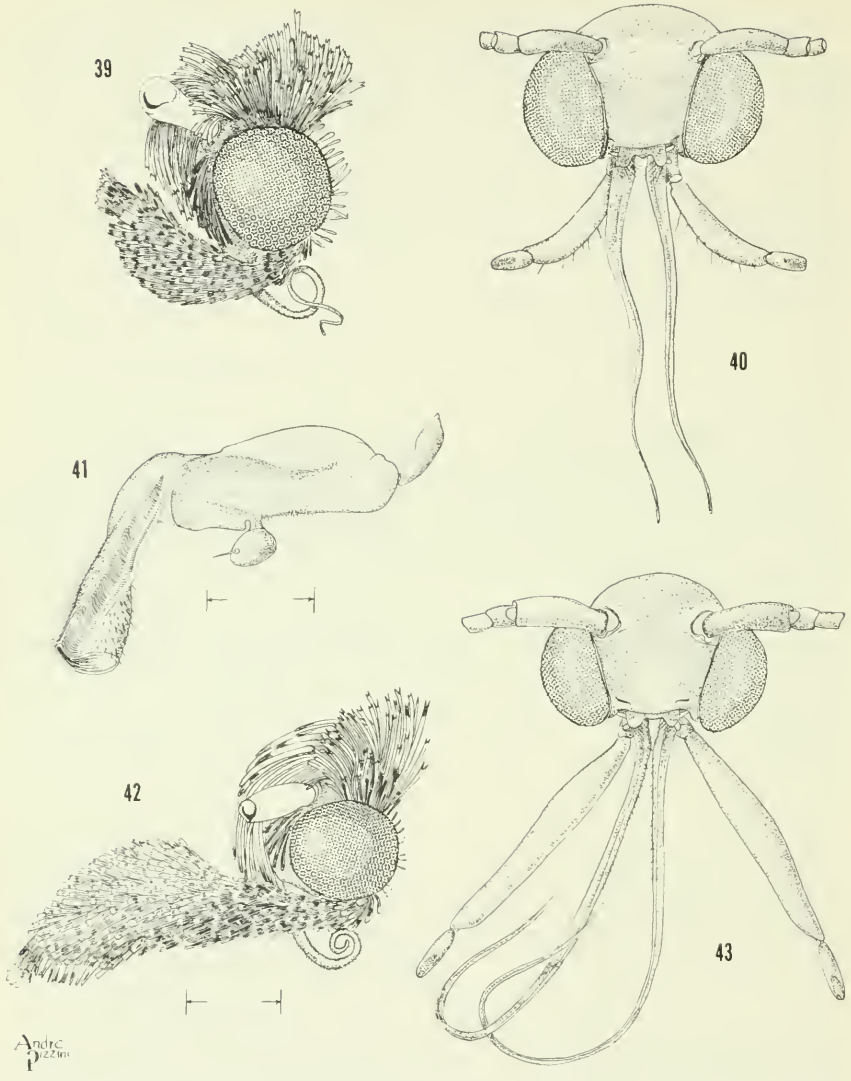




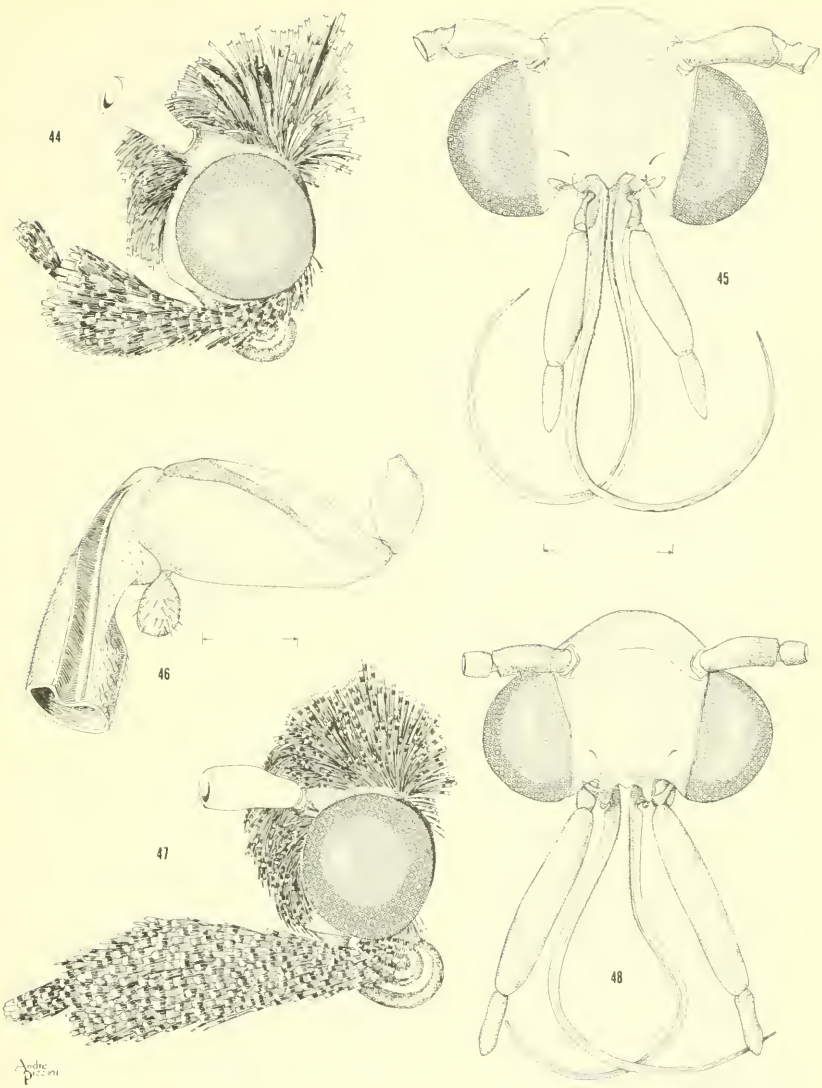




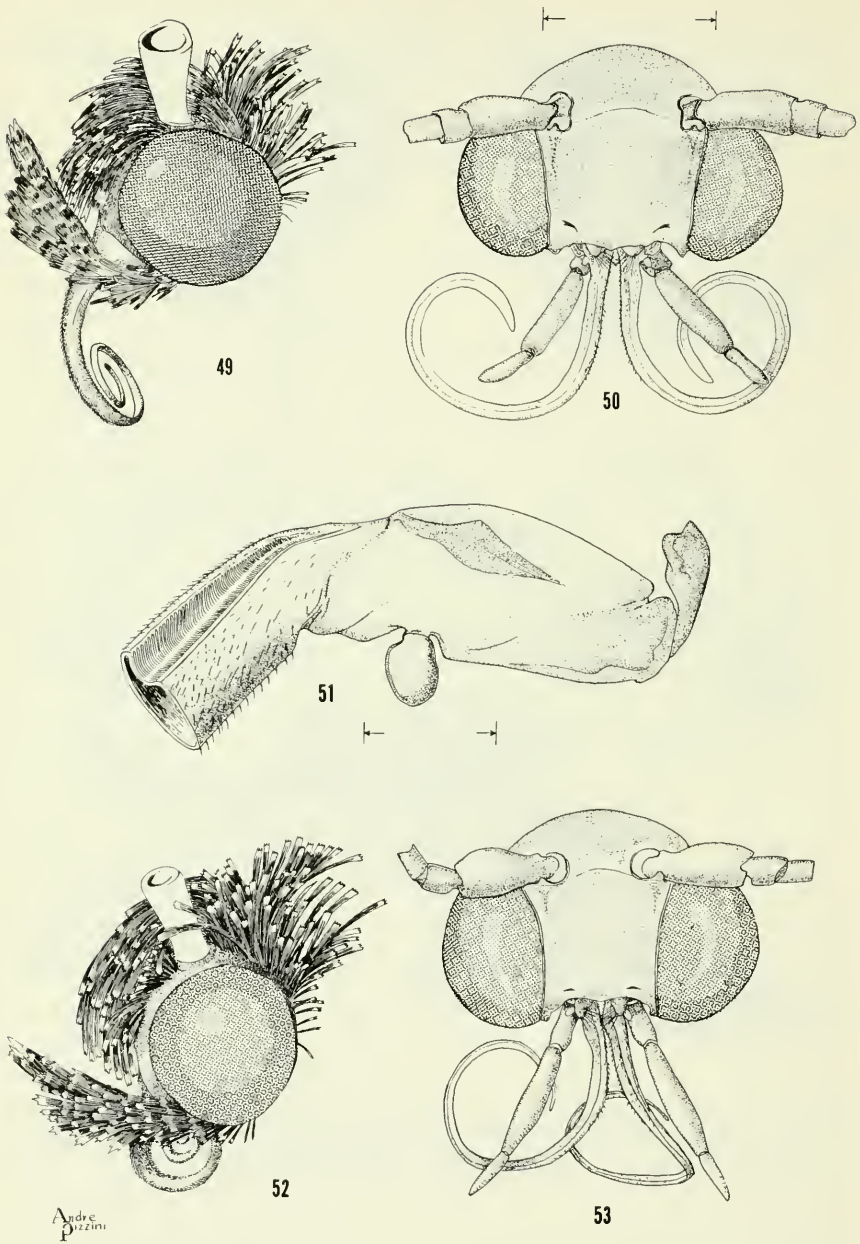
FIGURES 33–38.—Wing venation: 33, *Carposina (Hypopremna) bullata;* 34, *Atoposea maxima;* 35, *Bondia nigella;* 36, *Bondia comonana;* 37, *Bondia fidelis;* 38, *Tesuquea hazleyana.*



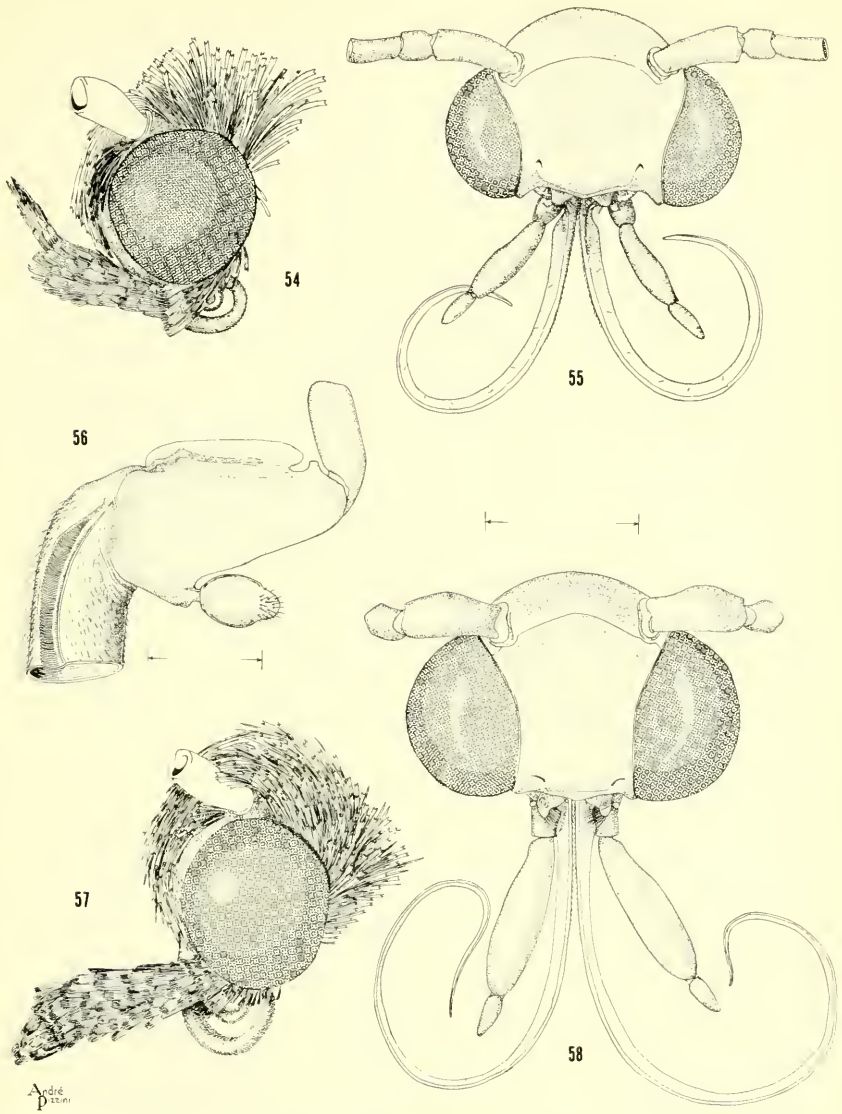
FIGURES 39–43.—Male and female heads of *Carposina* (*Carposina*) *fernaldana;* 39, lateral view of male; 40, frontal view of male; 41, maxilla of female; 42, lateral view of female; 43, frontal view of female. (Scale=0.1 mm. (fig. 41), 0.5 mm. (figs. 39–40, 42–43)).



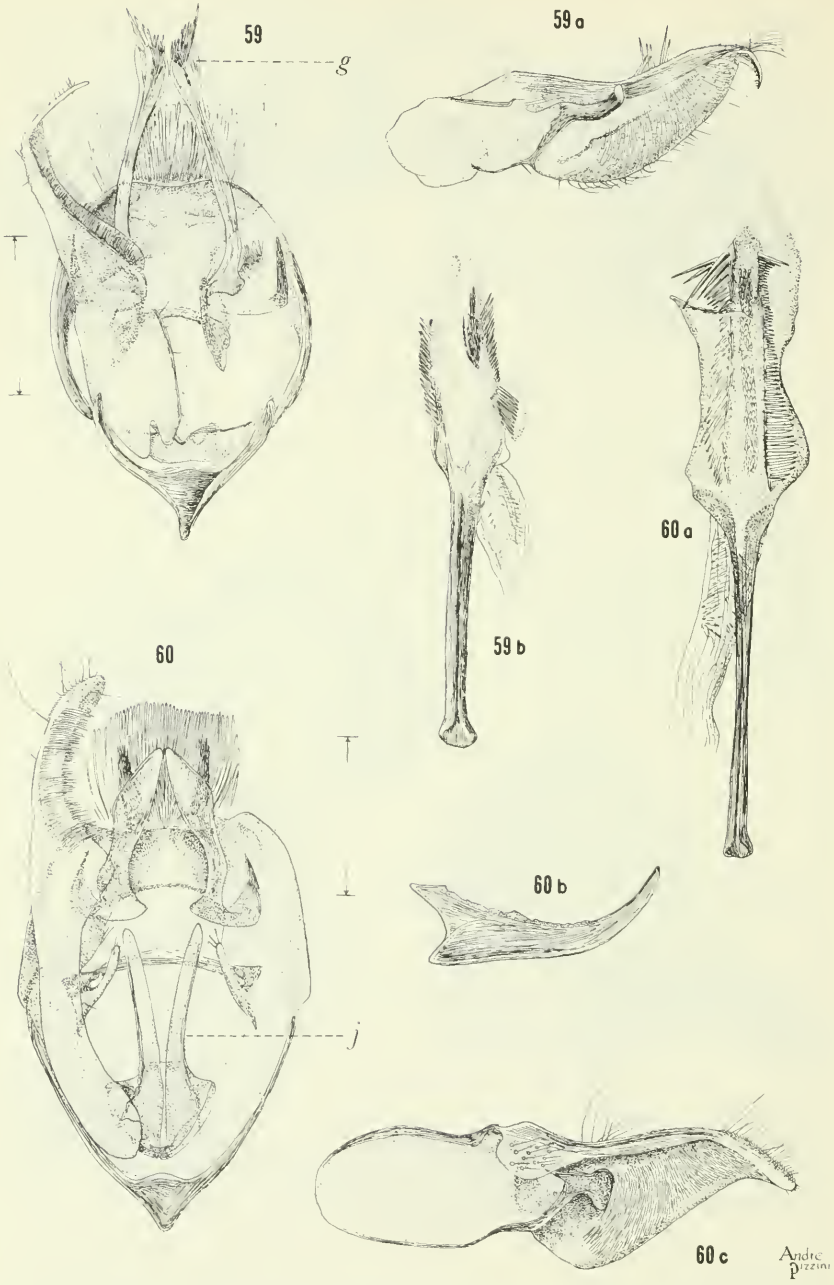
FIGURES 44–48.—Male and female heads of *Bondia comonana:* 44, lateral view of male; 45, frontal view of male; 46, maxilla of female; 47, lateral view of female; 48, frontal view of female. (Scale = 0.1 mm. (fig. 46), 0.5 mm. (figs. 44–45, 47–48)).



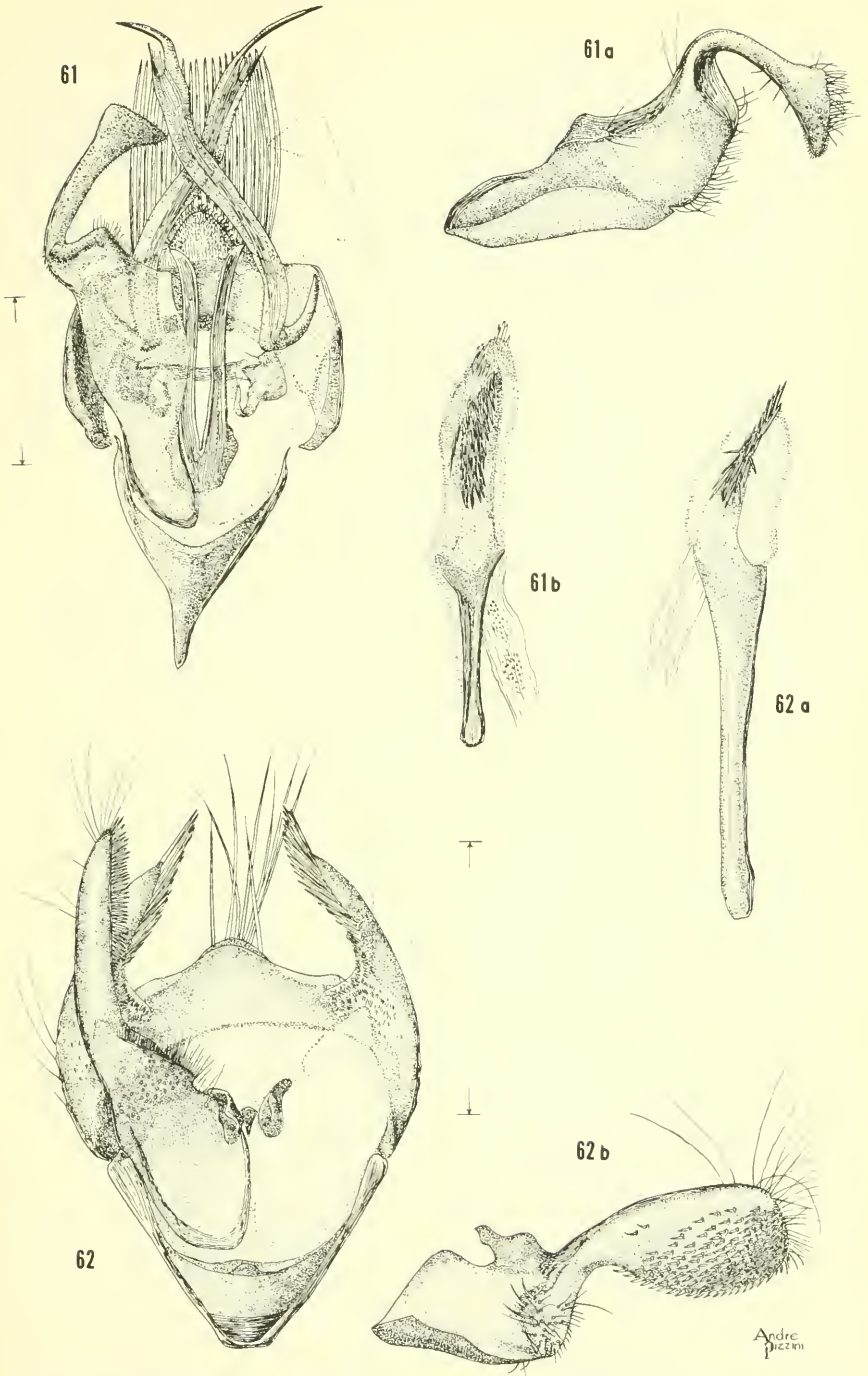
FIGURES 49–53.—Male and female heads of *Bondia fidelis:* 49, lateral view of male; 50, frontal view of male; 51, maxilla of female; 52, lateral view of female; 53, frontal view of female. (Scale=0.1 mm. (fig. 51), 0.5 mm. (figs. 49–50, 52–53)).



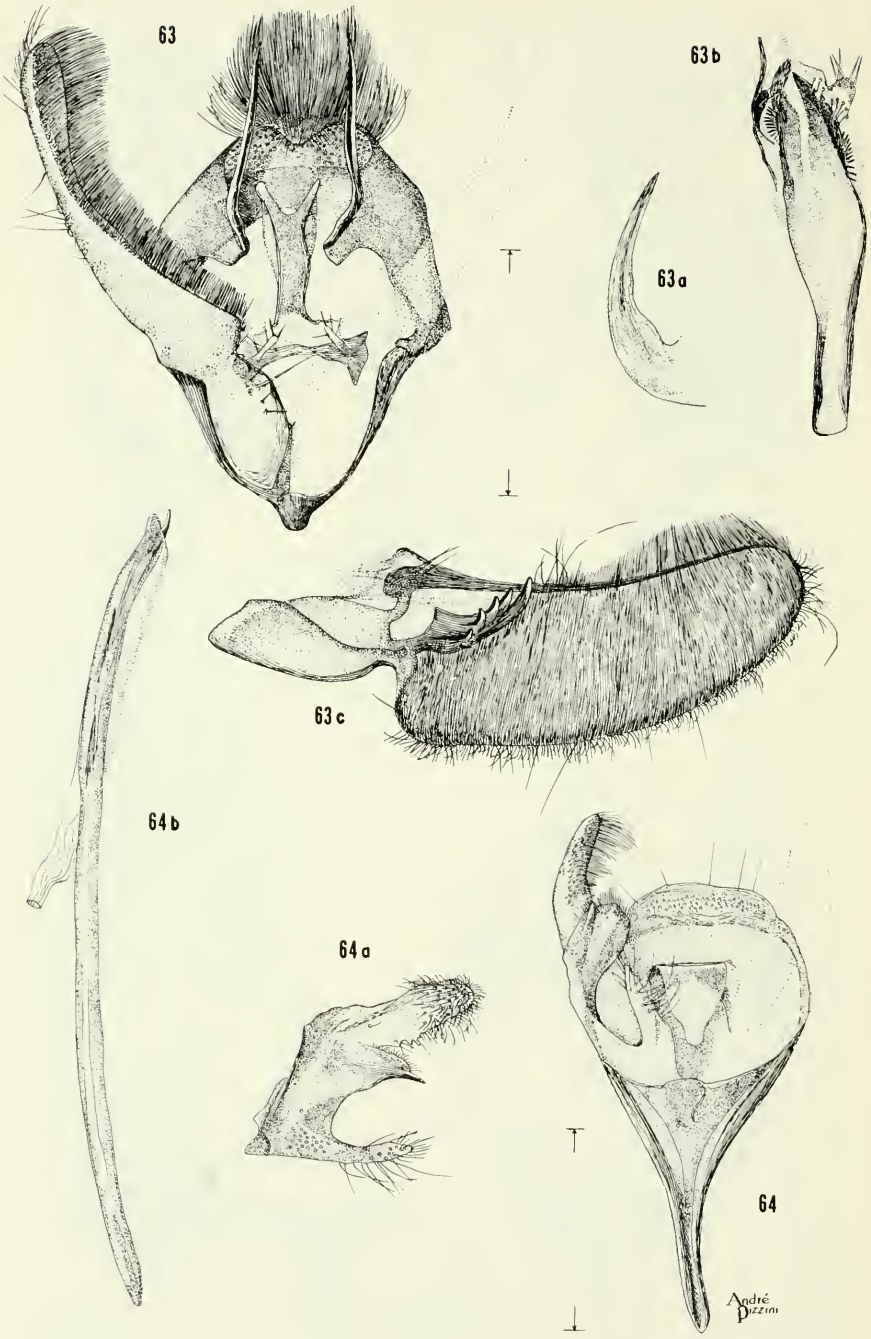
FIGURES 54–58.—Male and female heads of *Tesuquea hawleyana:* 54, lateral view of male; 55, frontal view of male; 56, maxilla of female; 57, lateral view of female; 58, frontal view of female. (Scale=0.1 mm. (fig. 56), 0.5 mm. (figs. 54–55, 57–58)).



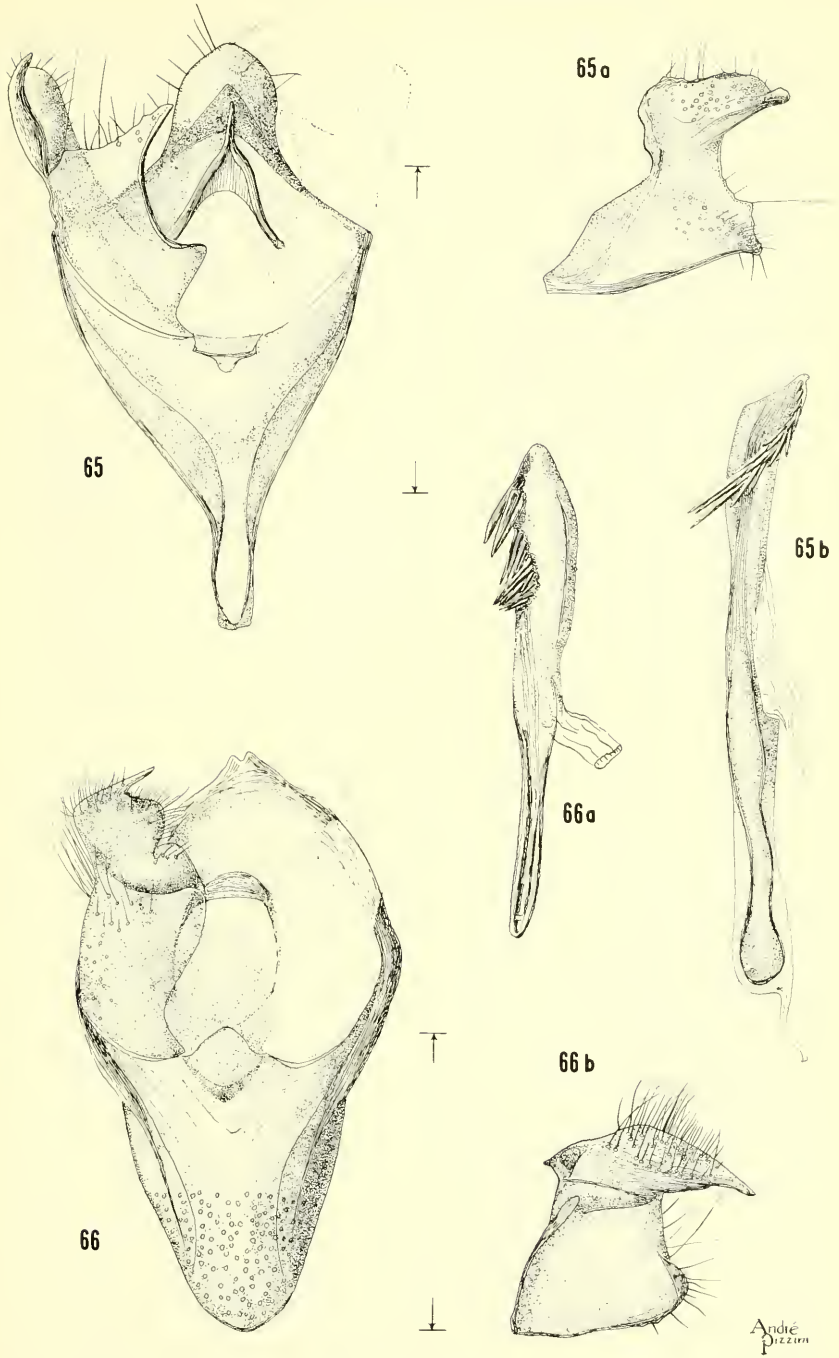
FIGURES 59–60.—Male genitalia: 59, *Carposina* (*Carposina*) *niponensis ottawana*, ventral view, g=gnathos; 59a, right valva; 59b, aedeagus; 60, *Carposina* (*Carposina*) *fernaldana*, ventral view, j=juxta; 60a, aedeagus; 60b, right lobe of juxta, lateral view; 60c, right valva. (Scale=0.5 mm.).



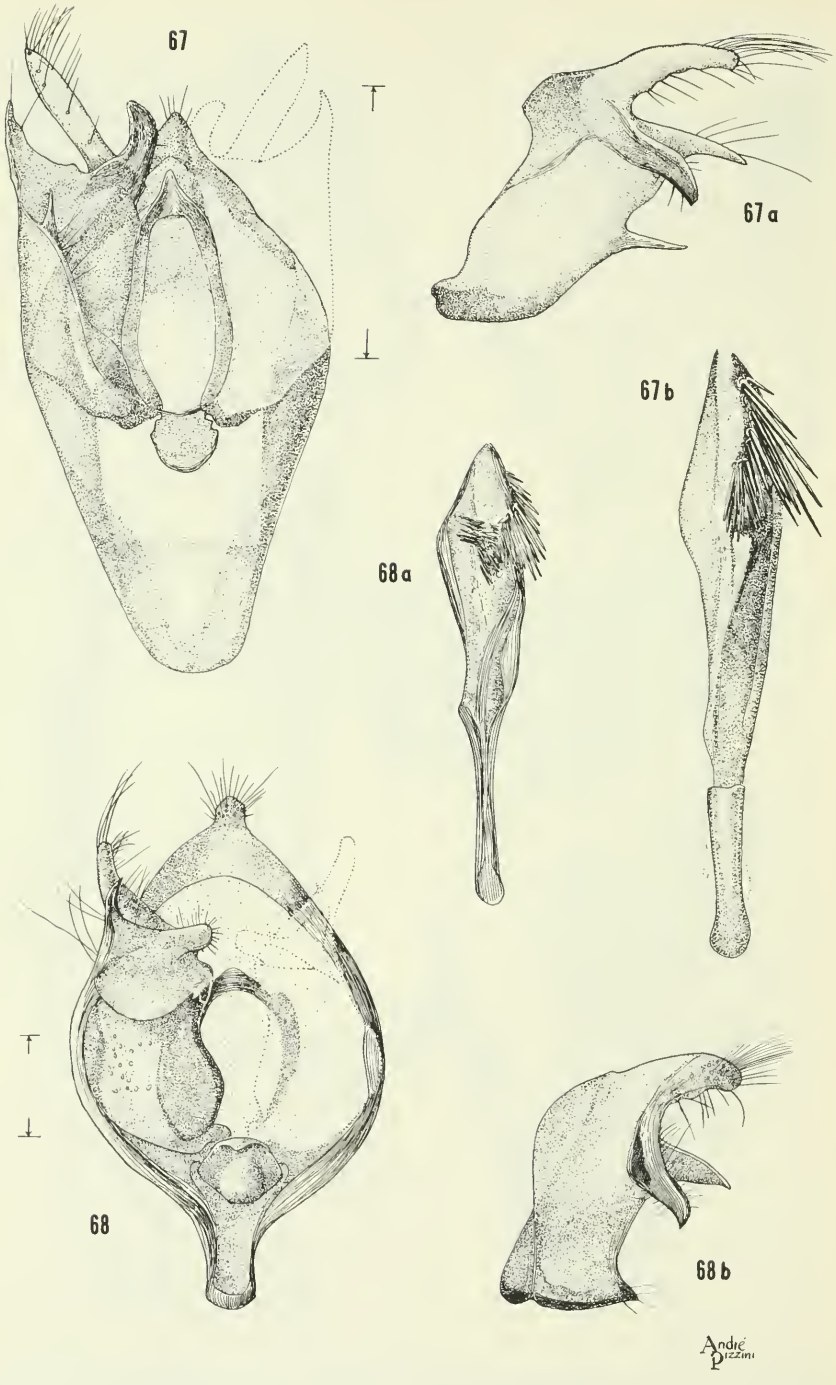
FIGURES 61–62.—Male genitalia: 61, *Carposina* (*Dipremna*) *cretata*, ventral view; 61a, right valva; 61b, aedeagus; 62, *Carposina* (*Epipremna*) *dominicae*, ventral view; 62a, aedeagus; 62b, right valva. (Scale=0.5 mm.).



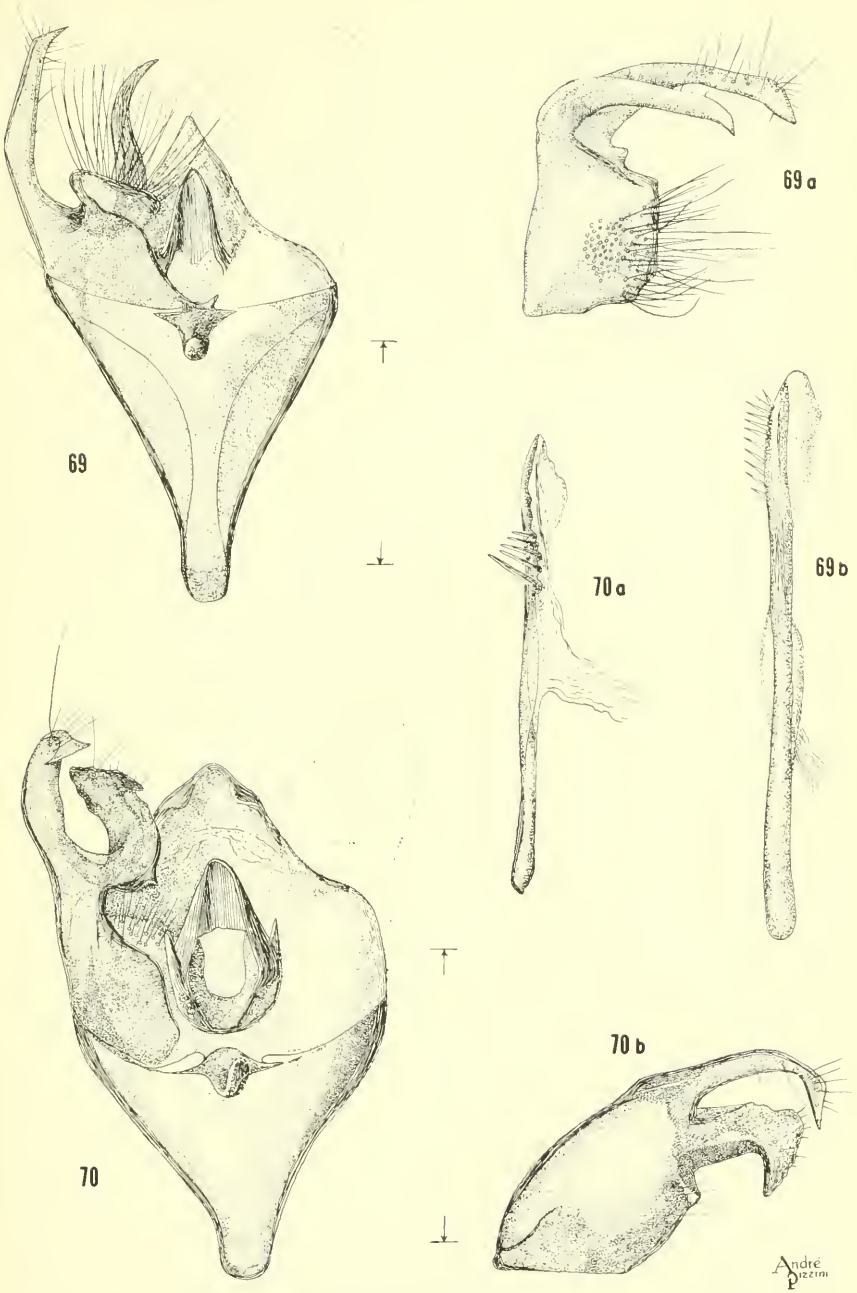
FIGURES 63–64.—Male genitalia: 63, *Atoposea maxima*, ventral view; 63a, lateral view of gnathos; 63b, aedeagus; 63c, right valva; 64, *Bondia comonana*, ventral view; 64a, right valva; 64b, aedeagus. (Scale=0.5 mm.).



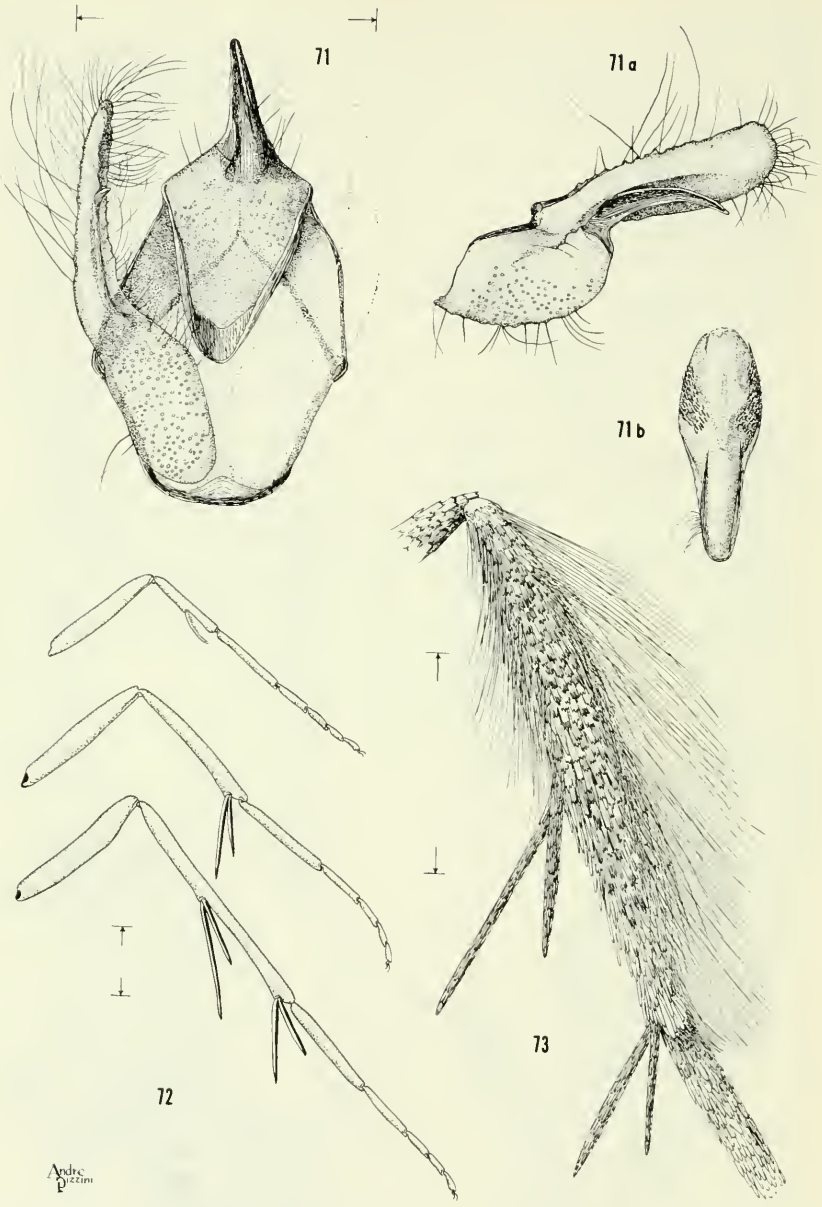
FIGURES 65-66.—Male genitalia: 65, *Bondia crescentella*, ventral view; 65a, right valva; 65b, aedeagus; 66, *Bondia fuscata*, paratype, ventral view; 66a, aedeagus; 66b, right valva. (Scale=0.5 mm.).



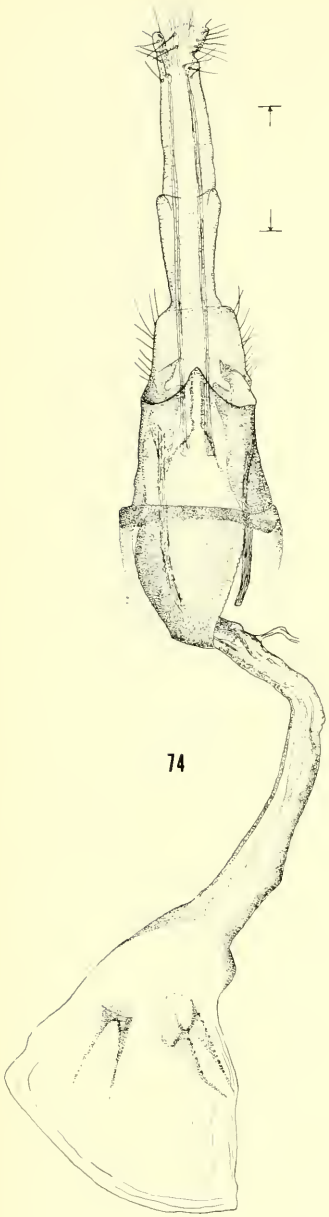
FIGURES 67–68.—Male genitalia, *Bondia fidelis:* 67, ventral view, Custer Co., Colorado; 67a, right valva; 67b, aedeagus; 68, ventral view, Hardy Work Camp. Lawrence Co., South Dakota; 68a, aedeagus; 68b, right valva. (Scale=0.5 mm.).

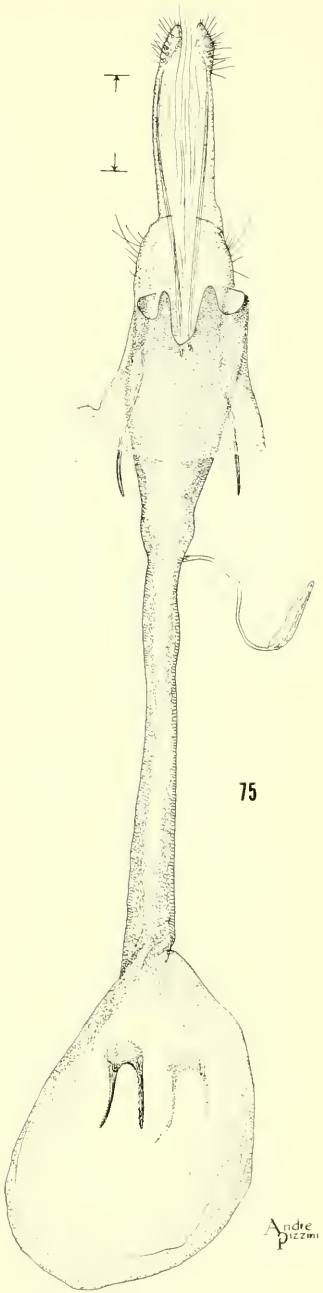


FIGURES 69–70.—Male genitalia: 69, *Bondia shastana*, holotype, ventral view; 69a, right valva; 69b, aedeagus; 70, *Bondia spicata*, holotype, ventral view; 70a, aedeagus; 70b, right valva. (Scale=0.5 mm.).

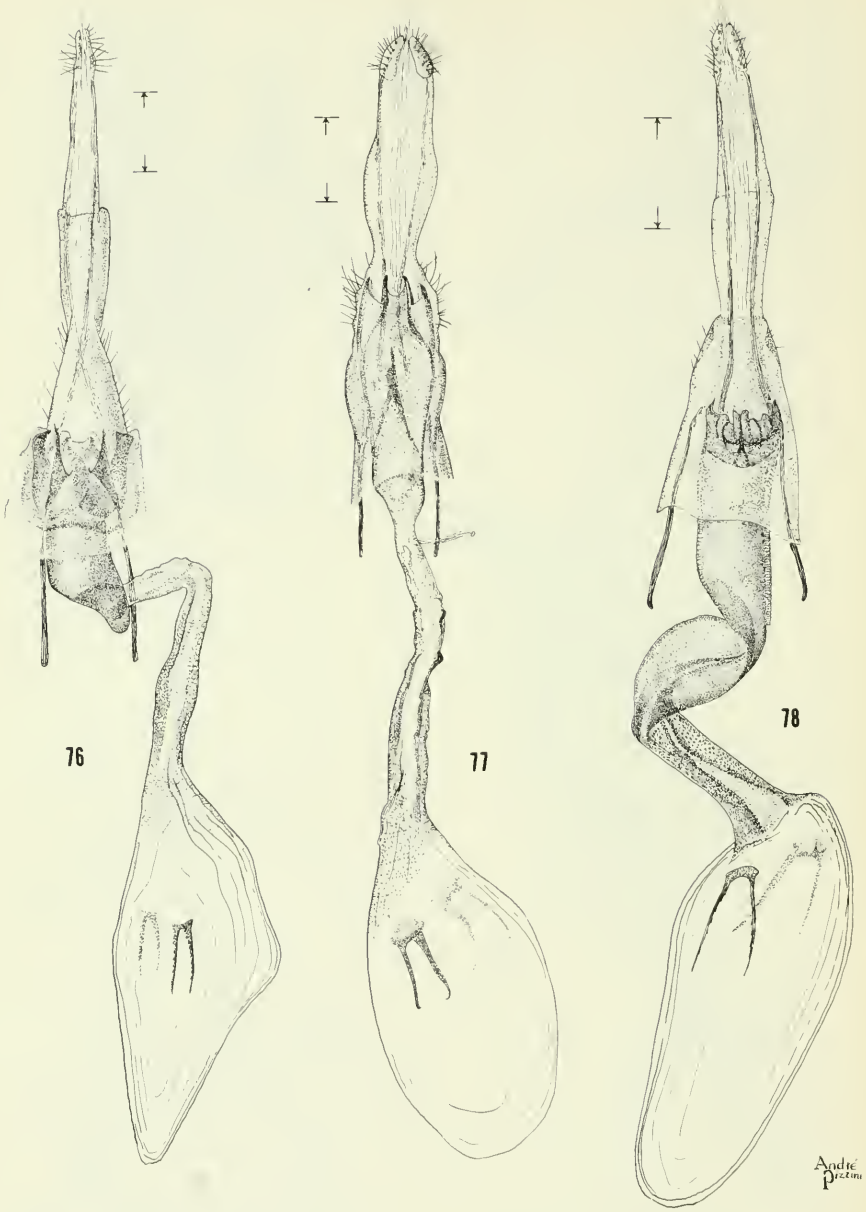


FIGURES 71–73.—Male genitalia and legs: 71, *Tesuquea hawleyana*, ventral view of male genitalia; 71a, right valva; 71b, aedeagus; 72, legs of *Carposina* (*Carposina*) *fernaldana;* 73, tibia of *Carposina* (*Carposina*) *fernaldana*, lateral view. (Scale=0.5 mm. (fig. 71), 1.0 mm. (figs. 72–73)).

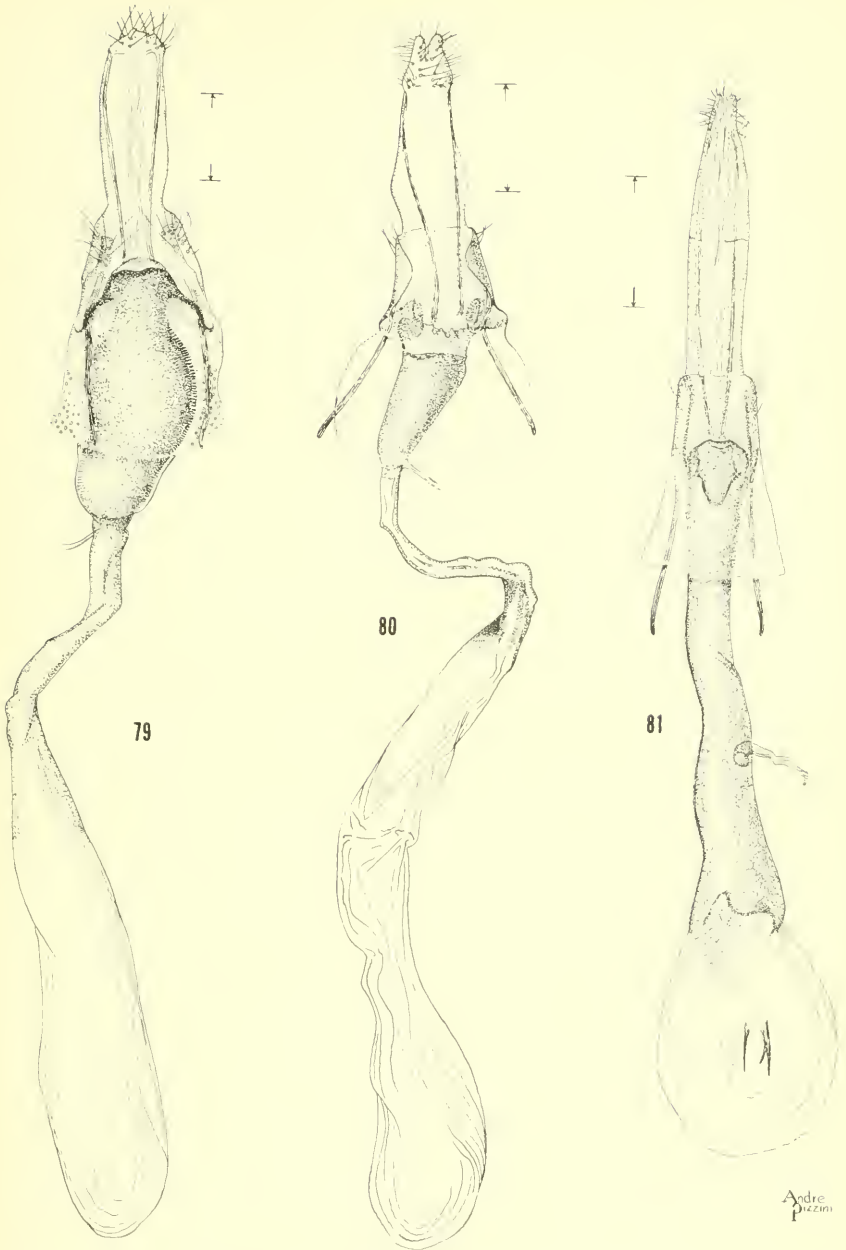




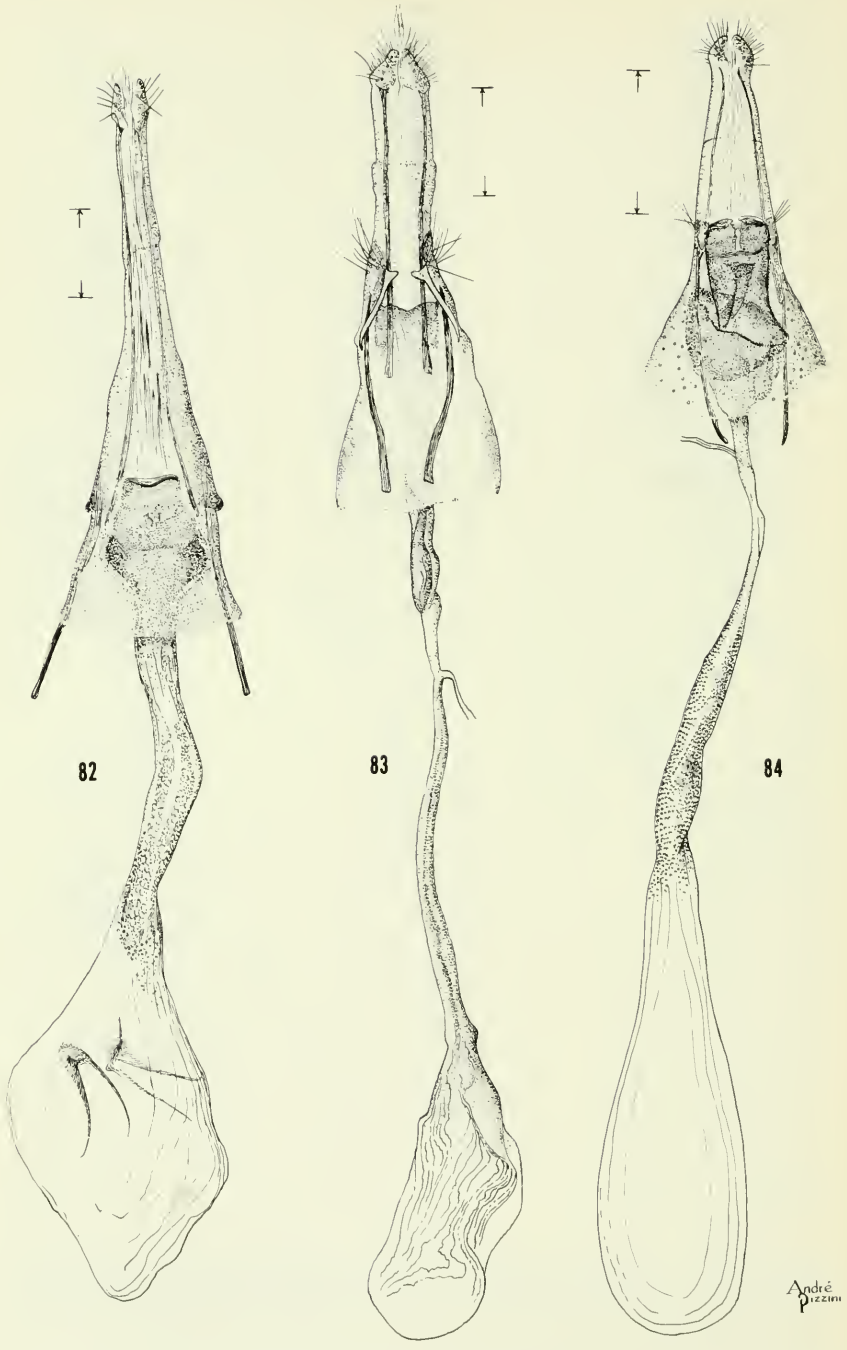
FIGURES 74–75.—Female genitalia: 74, *Carposina* (*Carposina*) *niponensis ottawana;* 75, *Carposina* (*Carposina*) *biloba*, holotype. (Scale=0.5 mm.).



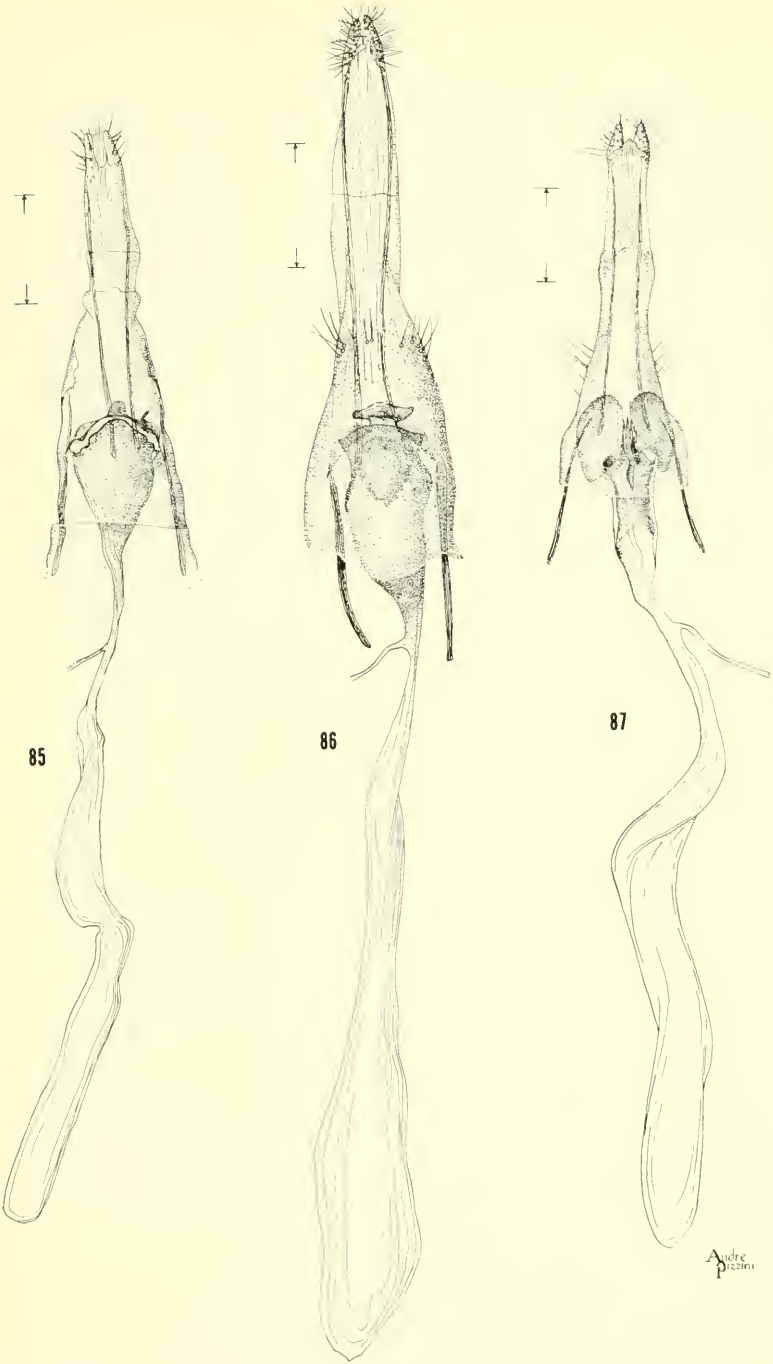
FIGURES 76–78.—Female genitalia: 76, *Carposina* (*Carposina*) *fernaldana;* 77, *Carposina* (*Carposina*) *simulator*, holotype; 78, *Carposina* (*Trepsitypa*) *cardinata.* (Scale=0.5 mm.).



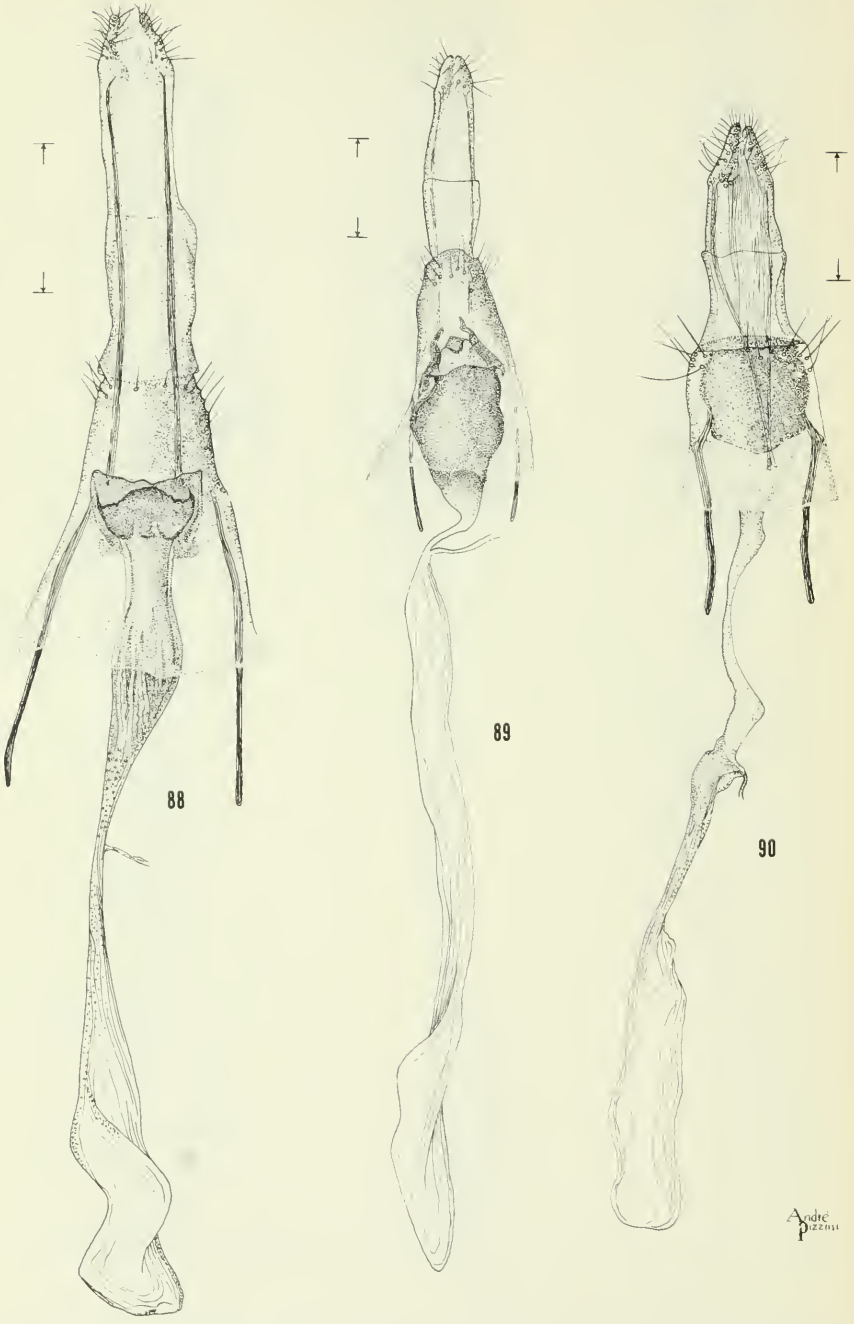
FIGURES 79–81.—Female genitalia: 79, *Carposina* (*Carposina*) *engalactis*, paralectotype; 80, *Carposina* (*Epipremna*) *dominicae*, paratype: 81, *Carposina* (*Hypopremna*) *bullata*. (Scale=0.5 mm.).



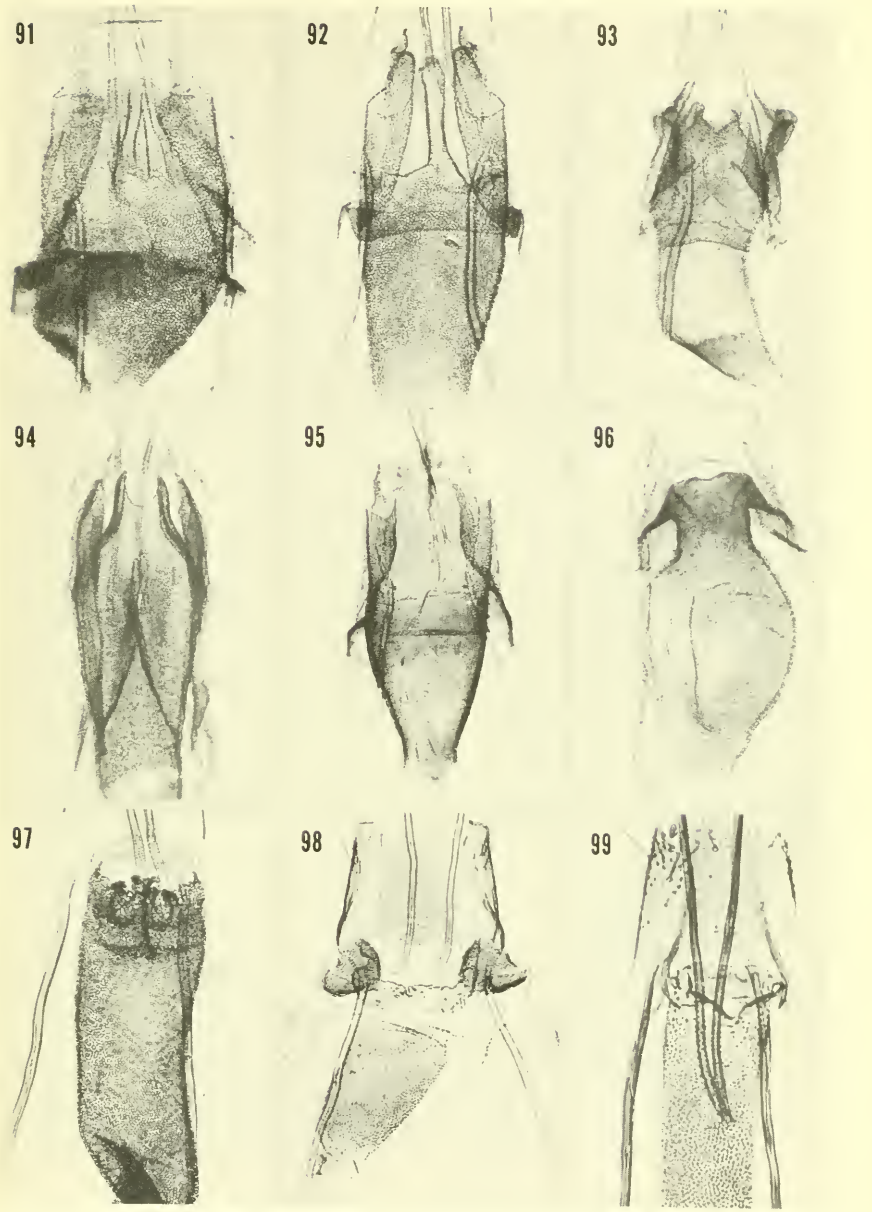
FIGURES 82–84.—Female genitalia: 82, *Carposina* species, no. 1; 83, *Bondia comonana;* 84, *Bondia crescentella.* (Scale=0.5 mm.).



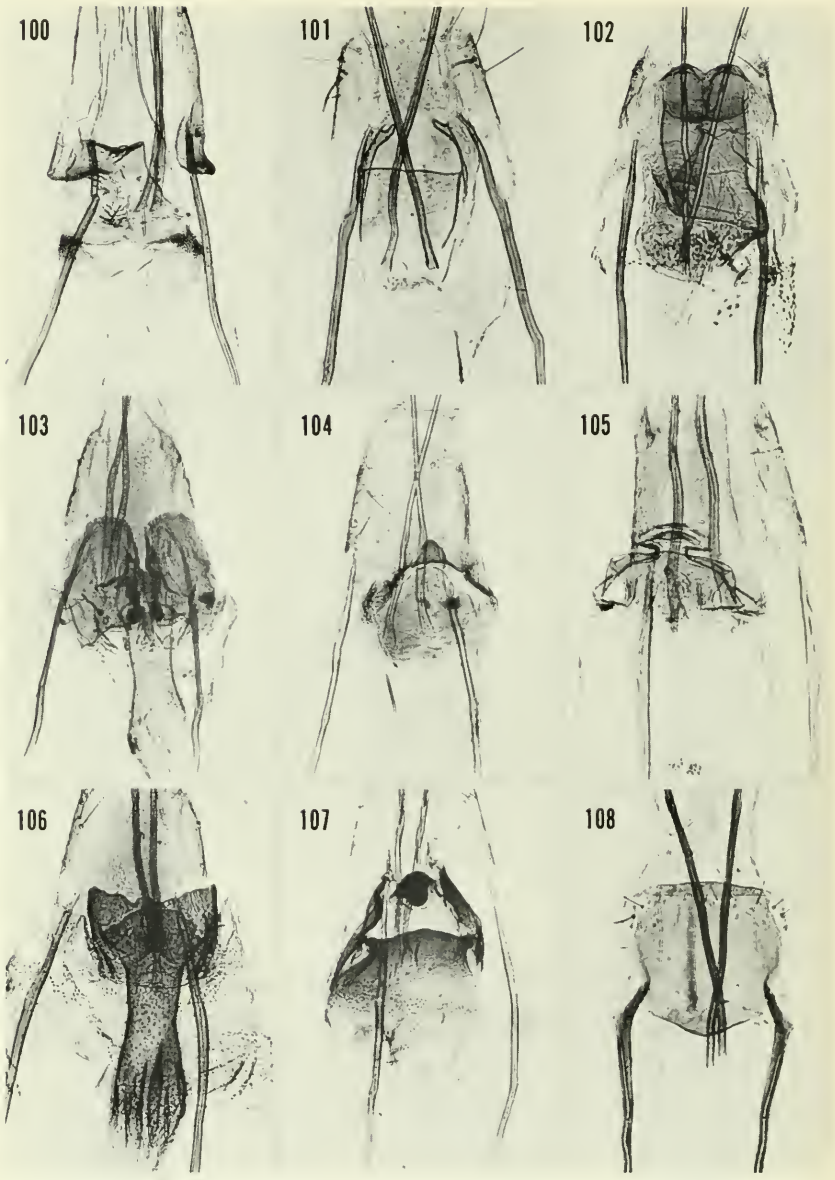
FIGURES 85–87.—Female genitalia: 85, *Bondia fidelis;* 86, *Bondia fuscata*, paratype; 87, *Bondia shastana*, paratype. (Scale=0.5 mm.).



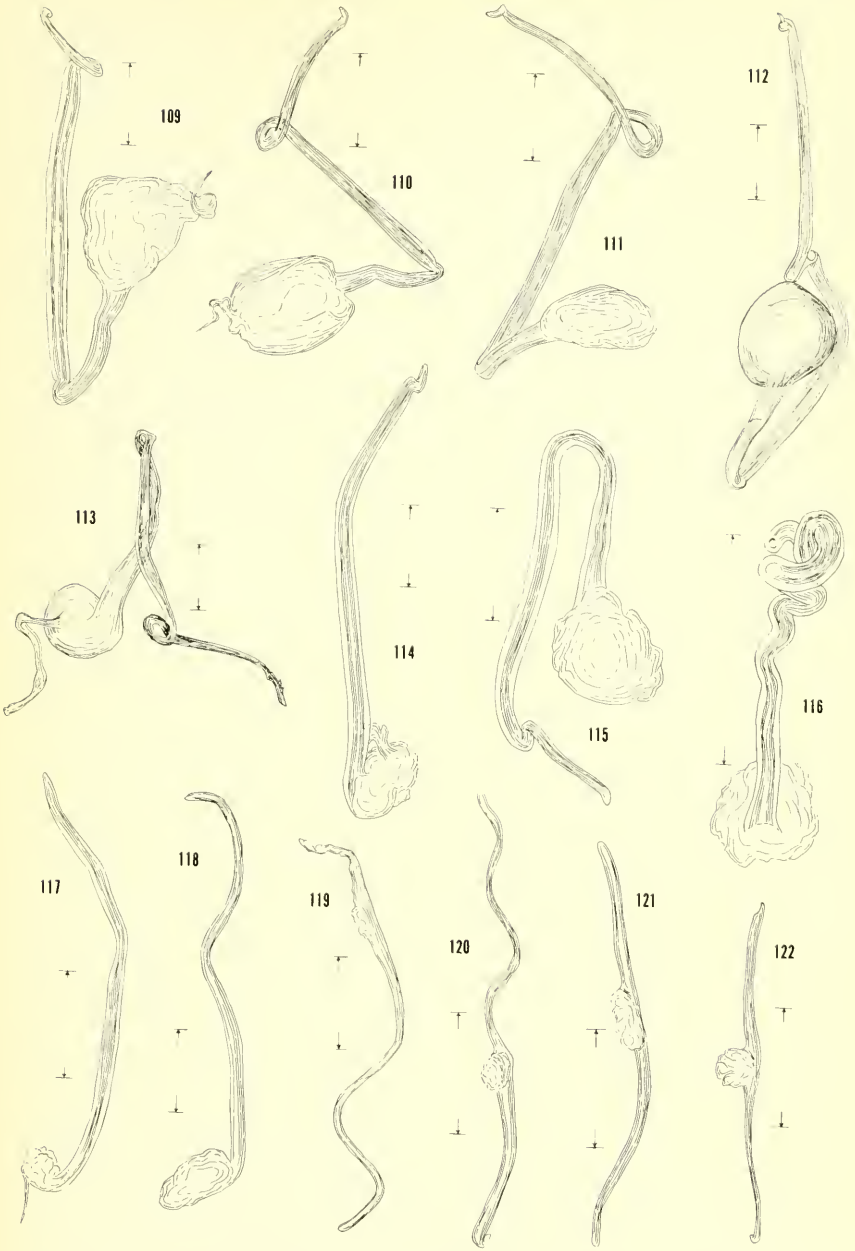
FIGURES 88–90.—Female genitalia: 88, *Bondia* species no. 1; 89, *Bondia* species no. 2; 90, *Tesuquea hawleyana*. (Scale=0.5 mm.).



FIGURES 91–99.—Lamella antevaginalis of female genitalia: 91, *Carposina* (*Carposina*) *niponensis niponensis* (Japan); 92, *Carposina* (*Carposina*) *niponensis ottawana;* 93, *Carposina* (*Carposina*) *fernaldana;* 94, *Carposina* (*Carposina*) *simulator*, holotype; 95, *Carposina* (*Carposina*) *biloba*, holotype; 96, *Carposina* (*Carposina*) *engalactis*, paralectotype; 97, *Carposina* (*Trepsitypa*) *cardinata;* 98, *Carposina* (*Epipremna*) *dominicae*, paratype; 99, *Carposina* (*Hypopremna*) *bullata.*



FIGURES 100–108.—Lamella antevaginalis of female genitalia: 100, *Carposina* species, no. 1; 101, *Bondia comonana;* 102, *Bondia crescentella;* 103, *Bondia shastana*, paratype; 104, *Bondia fidelis;* 105, *Bondia fuscata*, 106, *Bondia* species, no. 1; 107, *Bondia* species, no. 2; 108, *Tesuquea hawleyana.*



FIGURES 109–122.—Spermatophores: 109, *Carposina* (*Carposina*) *fernaldana;* 110, *Carposina* (*Carposina*) *niponensis ottawana;* 111, *Carposina* (*Carposina*) *simulator;* 112, *Carposina* (*Carposina*) *biloba;* 113, *Carposina* species, no. 1; 114, *Carposina* (*Epipremna*) *dominicae;* 115, *Carposina* (*Trepsitypa*) *cardinata;* 116, *Tesuquea hawleyana;* 117, *Bondia comonana; 118, Bondia crescentella;* 119, *Bondia shastana;* 120, *Bondia* species, no. 2; 121, *Bondia fidelis;* 122, *Bondia fuscata.* (Scale=0.5 mm.).

Index

[Names of new genera and species in italics, page numbers of principal accounts in boldface]

Anomoeosis, 9
Atoposea, 4, 10, 12, 13, **39**
Atoposea maxima, 9, 10, 31 (map), 39, **40,** 76 (fig.), 81 (fig.), 88 (fig.)
Autogriphus luteus, 3
berberidella, Carposina, 13, 16, 20, 80 (fig.)
biloba, Carposina, 10, 16, 25, **26** (map), 74 (fig.), 93 (fig.), 99 (fig.), 101 (fig.)
Bondia, 4, 7, 8 (table), 9, 10, 11, 12, 13, **41,** 43 (key), 53, 54, 57, 59
  comonana, 6, 8 (table), 10, 42, **43,** 46 (map), 73 (fig.), 76 (fig.), 81 (fig.), 83 (fig.), 88 (fig.), 96 (fig.), 100 (fig.), 101 (fig.)
  crescentella, 8 (table), 10, 42, 43, **47,** 49 (map), **76** (fig.), 89 (fig.), 96 (fig.), 100 (fig.), 101 (fig.)
  fidelis, 8 (table), 10, 42, 43, 53, **54,** 56 (map), 57, 59, 64, 66, 78 (fig.), 81 (fig.), 84 (fig.), 90 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
  fuscata, 8 (table), 10, 43, 56 (map), 57, **58,** 64, 78 (fig.), 89 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
  nigella, 41, 42, 57, 81 (fig.)
  shastana, 8 (table), 10, 43, **51,** 52 (map), 53, 54, 76 (fig.), 91 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
  species no. 1, 11, 43, **64,** 65 (map), 78 (fig.), 98 (fig.), 100 (fig.)
  species no. 2, 11, 43, 53, 57, **65** (map), 78 (fig.), 98 (fig.), 100 (fig.), 101 (fig.)
  spicata, 10, 43, 52 (map), **53,** 66, 78 (fig.), 91 (fig.)
bullata, Carposina, 8 (table), 9, 10, 15, 31 (map), 34, **37,** 76 (fig.), 95 (fig.), 99 (fig.)
Campanulaceae, 4
cardinata, Carposina, 2, 10, **30,** 31 (map), 74 (fig.), 80 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
Carposina, 3, 4, 6, 7, 8 (table), 9, 10, **13,** 15 (key), 16, 29, 32, 34, 35, 37, 39, 42
  berberidella, 13, 16, 20, 80 (fig.)
  biloba, 10, 16, 25, **26** (map), 74 (fig.), 93 (fig.), 99 (fig.), 101 (fig.)
  bullata, 8 (table), 9, 10, 15, 31 (map), 34, **37,** 76 (fig.), 95 (fig.), 99 (fig.)
  cardinata, 2, 10, **30,** 31 (map), 74 (fig.), 80 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
  comonana, 43, 44
  crescentella, 47, 49
  cretata, 8 (table), 10, 15, 32, **33,** 36 (map), 76 (fig.), 80 (fig.), 87 (fig.)
  dominicae, 8 (table), 10, 12, 14, 34, **35,** 36 (map), 76 (fig.), 80 (fig.), 87 (fig.), 95 (fig.), 99 (fig.) 101 (fig.)
  engalactis, 10, 16, **27,** 31 (map), 74 (fig.), 99 (fig.)
  euryleuca, 43, 46
  fernaldana, 6, 8 (table), 10, 17, **21,** 23 (map), 25, 26, 27, 74 (fig.), 80 (fig.), 82 (fig.), 86 (fig.), 92 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
  maxima, 40
  nicholsana, 10, 17
  niponensis niponensis, 4, 5, 18, 19, 99 (fig.)
  niponensis ottawana, 4, 8 (table), 9, 10, 15, **17,** 19 (map), 22, 23, 24, 74 (fig.), 86 (fig.), 93 (fig.), 99 (fig.), 101 (fig.)

Carposina—Continued
persicana, 20
phycitana, 2, 10, 17, **29**, 36 (map), 63, 74 (fig.)
sasakii, 20
scirrhosella, 20
simulator, 10, 17, **24**, 26 (map), 27, 74 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
species no. 1, 11, 12, 29, 36 (map), **62**, 78 (fig.), 96 (fig.), 100 (fig.), 101 (fig.)
species no. 2, 11, 29, 36 (map), **63**, 78 (fig.), 80 (fig.)
"Carposina", 7
Carposina, subgenus, 10, 15, **16** (key), 28, 62
Carposinae, 3
Carposinidae, 1, 2, 3, 4, 6, 9, **11**, 12 (key), 20
Carposinoidea, 1, 3
Commatarcha palaeosoma, 6
comonana, Bondia, 6, 8 (table), 10, 42, **43**, 46 (map), 73 (fig.), 76 (fig.), 81 (fig.), 83 (fig.), 88 (fig.), 96 (fig.), 100 (fig.), 101 (fig.)
comonana, Carposina, 43
Conchylidae, 3
Cornaceae, 18
Cornus paniculata, 18
racemosa, 18
Crataegus sp., 23
crescentella, Bondia, 8 (table), 10, 42, 43, **47**, 49 (map), 76 (fig.), 89 (fig.), 96 (fig.), 100 (fig.), 101 (fig.)
Carposina, 47, 49
cretata, Carposina, 8 (table), 10, 15, 32, **33**, 36 (map), 76 (fig.), 80 (fig.), 87 (fig.)
demissa, Prunus, 45
Dipremna, subgenus, 10, 15, **32**
domestica, Prunus, 45
dominicae, Carposina, 8 (table), 10, 12, 14, 34, **35**, 36 (map), 76 (fig.), 80 (fig.), 87 (fig.), 95 (fig.), 99 (fig.), 101 (fig.)
engalactis, Carposina, 10, 16, **27**, 31 (map), 74 (fig.), 99 (fig.)
Epacridaceae, 4
Epipremna, subgenus, 10, 15, **34**, 63
Ericaceae, 4
euryleuca, Carposina, 43, **46**
Fagaceae, 6, 45
fernaldana, Carposina, 6, 8 (table), 10, 17, **21**, 23 (map), 25, 26, 27, **74** (fig.), 80 (fig.), 82 (fig.), 86 (fig.), 92 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
fidelis, Bondia, 8 (table), 10, 42, 43, 53, **54**, 56 (map), 57, 59, 64, 66, 78 (fig.), 81 (fig.), 84 (fig.), 90 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
fuscata, Bondia, 8 (table), 10, 43, 56 (map), 57, **58**, 64, 78 (fig.), 89 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
Gelechiidae, 3
hawleyana, Tesuquea, 9, 11, 59, **60**, 61 (map), 78 (fig.), 85 (fig.), 92 (fig.), 98 (fig.), 100 (fig.), 101 (fig.)
Hypopremna, subgenus, 10, 15, **37**
Hyposmocoma, 4
jeffreyi, Pinus ponderosa var., 64
Lepidoptera, 1, 2
luteus, Autogriphus, 3
maxima, *Atoposea*, 9, 10, 31 (map), 39, **40**, **76** (fig.), 81 (fig.), 88 (fig).
Meridarchis, 7, 9, 34, 35
Metrogenes, 11
morbosa, Plowrightia, 6, 45
Myrtaceae, 4
nicholsana, Carposina, 10, 17
nigella, Bondia, 41, 42, 57
niponensis, Carposina niponensis ssp., 4, 5, 18, 19, 99 (fig.)
Olethreutinae, 3
ottawana, Carposina niponensis ssp., 4, 8 (table), 9, 10, 15, **17**, 19 (map), 22, 23, 24, **74** (fig.), 86 (fig.), 93 (fig.), 99 (fig.), 101 (fig.)
palaeosoma, Commatarcha, 6
paniculata, Cornus, 18
persica, Prunus, 45
persicana, Carposina, 20
Phaloniinae, 3
phycitana, Carposina, 2, 10, 17, **29**, 36 (map), 63, 74 (fig.)
Pinus ponderosa var. jeffreyi, 64

Plowrightia morbosa, 6, 45
Prunus, 6, 45
demissa, 45, 73 (fig.)
domestica, 45
persica, 45
sp., 73 (fig.)
virginiana, 45
Pseudomonas tumefaciens, 46
Quercus sp., 45
racemosa, Cornus, 18
Ribes sp., 18
Rosaceae, 4, 23, 45
sasakii, Carposina, 20
Saxifragaceae, 18
scirrhosella, Carposina, 20
shastana, Bondia, 8 (table), 10, 43, **51**, 52 (map), 53, 54, 76 (fig.), 91 (fig.), 97 (fig.), 100 (fig.), 101 (fig.)
simulator, Carposina, 10, 17, **24**, 26 (map), 27, 74 (fig.), 94 (fig.), 99 (fig.), 101 (fig.)
spicata, Bondia, 10, 43, 52 (map), **53**, 66, 78 (fig.), 91 (fig.)
Tesuquea, 4, 7, 11, 13, 59
Tesuquea hawleyana, 9, 11, 59, **60**, 61 (map), 78 (fig.), 85 (fig.), 92 (fig.), 98 (fig.), 100 (fig.), 101 (fig.)
Tineidae, 3
Tortricidae, 3, 5
Tortricina, 3
Tortricinae, 3
Tortricoidea, 3
Trepsitypa, subgenus, 10, 15, **30**, 32, 63
Trepsitypa cardinata, 30
tumefaciens, Pseudomonas, 46
virginiana, Prunus, 45

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